THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.

VOLUME THE TWENTY-SECOND.

PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1886.

THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET AND CHARING CROSS.

CONTENTS OF PART I., VOLUME XXII.

SECOND SERIES.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume;* the first volume belonging to 1839–40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

ERRATA.

In the paper in the last number of the 'Journal' (Vol. XXI. s.s., Part 2, 1885)—"On the Valuation of Unexhausted Manures," by Sir J. B. Lawes and Dr. Gilbert—the following corrections should be made:—

Table II. p. 601, No. 5, "Undecorticated Cotton-cake":—

Last column but one—*instead of* 5*s.* 11*d.*, *read* 9*s.* 3*d.*

Last column—*instead of* £3 5*s.* 4*d.*, *read* £3 8*s.* 8*d.*

Table III. p. 606, No. 5, "Undecorticated Cotton-cake":—

	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	£	*s.*	*d.*
Instead of—	3	5	4	1	12	8	1	1	10	14	6	9	8	6	6	4	4	2	10	1	11	4	14	3
Read—	3	8	8	1	14	4	1	2	11	15	3	10	2	6	10	4	6	3	0	2	0	4	19	0

Also—

Page 641, to the signatures of the Judges of Thoroughbreds and Hunters, *add* "COVENTRY."

Page 644, line 50, *for* "I consider the prize-winner," *read* "I consider the prize-winners."

Page 742, lines 11–13, the young man who slipped on one of the barriers, is stated to have recovered from his injuries, and did not die in the Preston Royal Infirmary, as reported.

METEOROLOGY; IMPORTATIONS OF GRAIN; SALES OF BRITISH WHEAT; PRICES OF CORN AND OTHER PRODUCE; AGRICULTURAL STATISTICS; AND STATISTICS OF DAIRY PRODUCE.

[*The facts are derived chiefly from the Meteorological Reports of* Mr. GLAISHER, *and the Returns of the* BOARD OF TRADE *and of the* INSPECTOR-GENERAL OF IMPORTS AND EXPORTS.]

METEOROLOGY.—1885.

First Quarter (*January, February, March*).—The mean reading of the barometer was 29·719 inches, and was 0·047 below the mean reading for the corresponding period of 44 years; the mean reading was below the average in January and February, while that in March was above the average.

The weather in January was dull with very little sunshine; the temperature was variable till the 11th, it then was cold from the 12th to the 26th, and then warm to the end of the month. The atmospheric pressure was above its average till the 7th, and again between the 15th and 26th days, and below at other times. The fall of rain was below the average. There was a marked excess of the E. and deficiency of S.W. winds. Snow fell on 11 different days at different parts of the country. It was a seasonable month of winter weather.

The weather in February was unsettled, with frequent heavy falls of rain. The temperature was above its average on every day excepting from the 18th to the 22nd, which were slightly below. The atmosphere pressure was generally below its average, excepting from the 10th to the 13th days. The fall of rain was above the average. The S.W. and W. winds were slightly in excess of their average. There were a few bright, warm days, but the sky was generally cloudy. The month was seasonable.

The weather in March was dry and cold, with frequent frost at

night. The temperature with the exception of three or four days, scattered over the month, was below the average. The atmospheric pressure was generally below the average till the 9th, and from the 18th to the 22nd, and above on other days. The fall of rain was less than the average at nearly all the stations, and there was an excess of easterly and compounds with easterly winds. The month was favourable for agricultural purposes, but vegetation at the end of the month was backward. It was the coldest March since 1875, excepting that in 1883, when the mean temperature of this month was 36°·1.

The *mean temperature* of the air for the quarter was 40°·3, and was 1°·5 above the average for the corresponding period of 114 years.

The *rainfall* measured at Greenwich during the quarter was 5·26 inches, and was 0·26 inches above the average amount in the corresponding period of 69 years. The rainfall was below the average in January and March, but in excess of the average in February. Rain was measured at Greenwich on 15 days in January, 19 in February, and 8 in March, or on 42 of the 90 days in the quarter. The rainfall recorded at 41 stations of observation ranged from 4·03 inches at Cambridge, 4·24 at Cardington, and 4·36 at Lowestoft, to 10·39 inches at Stonyhurst, 10·65 at Bath, 11·24 at Bolton, and 11·28 at Totnes.

The number of hours of bright sunshine recorded during the quarter at the Royal Observatory, Greenwich, was 160·2, against 201·4 and 148·7 in the two preceding corresponding quarters.

Second Quarter (*April, May, June*).—The mean reading of the barometer at Greenwich was 29·700 inches, and was 0·082 below the mean reading for the corresponding period of 44 years; the mean reading was below the average in April and May, while that in June was above the average.

The weather in April was cold till after the middle, and warm from the 17th to the end of the month, the barometer readings were generally low throughout the month, the average pressure being reached or exceeded on nine days only. The direction of the wind during the first half of the month was E. and N.W. and it was chiefly S.W. from the 17th. The rainfall was about its average; snow fell on four different days.

The weather in May was cold throughout the month. The atmospheric pressure was variable, for a few days together above its average, and then a few days below. There was an excess of N.W. winds; snow fell on six different days within the first ten days of the month.

The weather in June was dry, the temperature very variable; it was warm till the 8th; then cold for three days, and warm on the 12th, 13th, and 14th, after which it was mostly cold. The atmospheric pressure was variable throughout the month; the East wind was prevalent. During the last week or ten days the weather was favourable for haymaking; vegetation was backward but generally luxuriant.

The *mean temperature* of the air for the quarter was 52°·4, and was 0°·1 above the average for the corresponding period of 114 years.

The *rainfall* measured at Greenwich during the quarter was 5·82 inches, and was almost identical with the average amount for the corresponding period of 70 years. The rainfall was above the average in April and May, and below the average in June. Rain was measured at Greenwich on 9 days in April, 19 in May, and 7 in June, or on 35 of the 91 days in the quarter. The rainfall recorded at 37 stations of observation ranged from 3·34 inches at Llandudno, and 4·35 inches at Carlisle, to 9·37 inches at Barnstaple, and 9·51 inches at Bolton.

The number of hours of bright sunshine recorded during the quarter at the Royal Observatory, Greenwich, was 524·0, and exceeded the amount in any corresponding quarter on record.

Third Quarter (*July, August, September*).—The mean reading of the barometer at Greenwich was 29·835 inches, and was 0·043 above the mean reading for the corresponding period of 44 years; the mean reading was above the average in July and August, while that in September was below the average.

The weather in July was warm, the temperature being generally above the average. The barometer readings were high throughout the month. There were but three days in the month, viz., the 18th, 19th, and 20th, when the atmospheric pressure was a little less than the average. The month was remarkably dry, the fall of rain was less than half an inch at very many places, and at some the fall was less than a quarter of an inch, and at Whitchurch was less than the tenth of an inch. There was only one thunderstorm, viz., on the 13th, and that was only experienced at, about, and a little north of London. The almost total absence of either lightning or thunder was remarkable, and no hail fell. The want of rain at the end of the month was severely felt by all root crops.

The month of August was cold, there were only two days in the month, viz., the 16th and 17th, when the mean temperature reached its average. The atmospheric pressure was variable, for

a few days together above its average, and then a few days below. The fall of rain was generally less than the average, but sufficient to save the root crops. The month on the whole was fine and dry, and was favourable for harvest work.

The weather in September was unsettled, the temperature was variable, being for a few days together a little above the average, then for a few days a little below, till the last week in the month, when the cold was very severe. The atmospheric pressure was below its average till the 15th, and again after the 25th. The rainfall was considerably above its average, and it fell at most places on two out of three days during the month. The first snow fell at Carlisle on the 26th.

The *mean temperature* of the air during the quarter was 59°·1, and was 0°·6 below the average for the corresponding period of 114 years.

The *rainfall* measured at Greenwich during the quarter was 5·55 inches, and was 1·80 inches below the average amount in the corresponding period of 70 years. The rainfall was below the average in July and August, and above the average in September. Rain was measured at Greenwich on 5 days in July, 10 in August, and 21 in September, or on 36 of the 92 days in the quarter. The rainfall recorded at 36 stations of observation ranged from 4·20 inches at Southbourne, 4·44 inches at Bradford, and 4·73 inches at Cambridge, to 10·14 inches at Truro, 10·25 inches at Stonyhurst, and 11·52 inches at Bolton.

The number of hours of bright sunshine recorded during the quarter at the Royal Observatory, Greenwich, was 443·0, against 421·6 and 449·0 in the corresponding periods of 1883 and 1884.

***Fourth Quarter** (**October, November, December**).*—The mean reading of the barometer at Greenwich was 29·761 inches, and was 0·012 above the mean reading for the corresponding period of 44 years; the mean reading was below the average in October and November, while in December it was above the average.

The weather in October was wet and cold; the temperature of the air was below the average generally, and at times by large amounts. The atmospheric pressure was variable, but generally below its average, particularly on the 9th and 10th, when the weather was very stormy. The fall of rain in England was above its average. There was an excess of N.W. winds. Snow fell on two days. It was a most uncomfortable month.

The weather in November was generally cold till the 24th day, particularly so from the 15th, with occasional frosts; the last week was warm. The atmospheric pressure was generally above its

average till the 20th and below from the 21st. The fall of rain was generally somewhat less than its average. There was an excess of E. and N.E. winds. Snow fell on one day at a few places, fog was very prevalent. The month was dull, with very little sunshine.

The weather in December was gloomy, damp, and foggy. The temperature of the air was generally below the average during the first half of the month, and generally above it afterwards. The atmospheric pressure, with the exception of the days between the 4th and 7th and from the 28th, was high. The fall of rain was below the average. Snow fell frequently, but soon disappeared.

The *mean temperature* of the air during the quarter was 42°·8, and was 1°·0 below the average for the corresponding period in 114 years.

The *rainfall* measured at Greenwich during the quarter was 7·37 inches, and was 0·25 inches above the average amount in the corresponding period of 70 years. The rainfall was above the average in October and November, and below the average in December. Rain was measured at Greenwich on 23 days in October, 17 in November, and 13 in December, or on 53 of the 92 days in the quarter. The rainfall recorded at 36 stations of observation ranged from 5·82 inches at Carlisle, 6·29 inches at Rodmersham, 6·76 inches at Leeds, and 6·82 inches at Blackheath, to 13·02 inches at Guernsey, 13·90 inches at Bath, 15·60 inches at Bolton, and 15·85 inches at Truro.

The number of hours of bright sunshine recorded during the quarter at the Royal Observatory, Greenwich, was 113·3, against 143·2 and 101·6 in the corresponding periods of 1883 and 1884.

TABLE I.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE FIRST SIX MONTHS OF THE YEAR 1885.

1885.	Temperature of									Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Air.			Evaporation.		Dew Point.		Air—Daily Range.					
MONTHS.	Mean.	Diff. from average of 114 years.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
January	36·6	+0·1	−1·9	35·3	−1·7	33·4	−1·6	7·9	−1·7	0·191	−0·010	2·3	−0·1
February	43·9	+5·2	+4·3	42·1	+4·2	40·1	+4·7	10·8	−0·3	0·248	+0·039	2·9	+0·5
March	40·3	−0·8	−1·4	37·4	−1·9	33·8	−2·3	16·5	+1·8	0·194	−0·024	2·3	−0·2
Means	40·3	+1·5	+0·3	38·3	+0·2	35·8	+0·3	11·7	−0·1	0·211	+0·002	2·5	+0·1
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
April	47·7	+1·6	+0·7	44·3	+0·4	40·5	0·0	18·8	+0·4	0·252	−0·001	2·9	0·0
May	49·9	−2·6	−2·8	46·2	−2·7	42·2	−2·9	19·0	−1·5	0·269	−0·030	3·0	−0·4
June	59·5	+1·3	+0·6	54·6	+0·1	50·4	−0·3	21·7	+0·7	0·366	−0·004	4·1	−0·1
Means	52·4	+0·1	−0·5	48·4	−0·7	44·4	−1·1	19·8	−0·1	0·296	−0·012	3·3	−0·2

NOTE.—In reading this Table it will be borne in mind that the *minus* sign (−) signifies *below* the average, and that the *plus* sign (+) signifies *above* the average.

TABLE II.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE LAST SIX MONTHS OF THE YEAR 1885.

1885. MONTHS.	Temperature of Air.			Temperature of Evaporation.		Temperature of Dew Point.		Temperature of Air—Daily Range.		Elastic Force of Vapour.		Weight of Vapour in a Cubic Foot of Air.	
	Mean.	Diff. from average of 114 years.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
July	63·8	+2·1	+1·7	58·0	+0·3	53·2	−0·8	24·5	+3·5	0·406	−0·012	4·5	−0·2
August	58·5	−2·4	−3·0	54·4	−3·1	50·8	−3·2	20·0	+0·2	0·371	−0·049	4·2	−0·5
September	55·1	−1·4	−2·0	52·5	−1·5	50·0	−1·2	17·5	−0·8	0·391	−0·019	4·0	−0·3
Means	59·1	−0·6	−1·1	55·0	−1·4	51·3	−1·7	20·7	+1·0	0·379	−0·027	4·2	−0·3
	°	°	°	°	°	°	°	°	°	in.	in.	grs.	grs.
October	46·1	−3·7	−3·9	43·9	−4·0	41·4	−4·4	12·3	− 2·3	0·261	−0·049	3·1	−0·9
November	43·3	+1·0	−0·2	42·0	+0·7	40·5	+1·1	10·3	− 1·2	0·252	+0·007	2·9	+0·1
December	38·9	−0·2	−1·0	37·5	−1·0	35·3	−1·4	8·9	− 0·5	0·206	−0·013	2·5	−0·1
Means	42·8	−1·0	−1·7	41·1	−1·4	39·1	−1·6	10·5	− 1·3	0·240	−0·018	2·8	−0·3

NOTE.—In reading this Table it will be borne in mind that the *plus* sign (+) signifies *above* the average, and that the *minus* sign (−) signifies *below* the average.

TABLE III.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE FIRST SIX MONTHS OF THE YEAR 1885.

1885. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Amount.	Diff. from average of 70 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
January ..	88	+ 1	29·713	−0·043	555	+ 1	1·42	−0·46	324	16	13	2	16·9	46·2
February ..	86	+ 1	29·543	−0·248	543	−10	2·34	+0·75	361	6	17	5	22·7	47·5
March ..	78	− 3	29·900	+0·151	554	+ 4	1·50	−0·03	274	24	7	0	20·5	37·4
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	83	0	29·719	−0·047	551	− 2	5·26	−0·26	320	46	37	7	16·9	47·5
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
April ..	77	− 3	29·616	−0·133	541	− 2	2·05	+0·31	293	10	17	3	22·9	43·8
May	76	− 3	29·628	−0·164	538	− 2	2·10	+0·05	282	8	16	7	23·2	50·3
June ..	73	− 2	29·857	+0·052	532	0	1·67	−0·33	271	0	14	16	30·1	54·3
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	75	− 3	29·700	−0·082	537	− 1	5·82	+0·01	282	18	47	26	22·9	54·3

NOTE.—In reading this Table it will be borne in mind that the *plus* sign (+) signifies *above* the average, and that the *minus* sign (−) signifies *below* the average.

TABLE IV.—METEOROLOGICAL OBSERVATIONS RECORDED AT THE ROYAL OBSERVATORY, GREENWICH, IN THE LAST SIX MONTHS OF THE YEAR 1885.

1885. MONTHS.	Degree of Humidity.		Reading of Barometer.		Weight of a Cubic Foot of Air.		Rain.		Daily Horizontal movement of the Air.	Reading of Thermometer on Grass.				
										Number of Nights it was			Lowest Reading at Night.	Highest Reading at Night.
	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Mean.	Diff. from average of 44 years.	Amount.	Diff. from average of 70 years.		At or below 30°.	Between 30° and 40°.	Above 40°.		
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
July	69	− 7	29·996	+0·202	530	+ 2	0·50	−2·04	222	0	9	22	32·6	57·8
August ..	76	0	29·796	+0·013	532	+ 4	1·32	−1·06	259	0	13	18	30·4	52·8
September	83	+ 2	29·713	−0·086	534	+ 1	3·73	+1·30	275	3	9	18	22·3	55·8
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	76	− 2	29·835	+0·043	532	+ 2	5·55	−1·80	252	3	31	58	22·3	57·8
			in.	in.	grs.	grs.	in.	in.	Miles.				°	°
October ..	84	− 4	29·530	−0·184	541	+ 1	3·41	+0·61	327	7	22	2	22·2	41·2
November	90	+ 1	29·721	−0·021	547	− 1	2·83	+0·50	281	11	12	7	19·5	44·1
December	87	− 1	30·031	+0·241	558	+ 5	1·13	−0·86	284	15	16	0	18·8	40·0
							Sum	Sum	Mean	Sum	Sum	Sum	Lowest	Highest
Means ..	87	− 1	29·761	+0·012	549	+ 2	7·37	+0·25	297	33	50	9	18·8	44·1

NOTE.—In reading this Table it will be borne in mind that the *plus* sign (+) signifies *above* the average, and that the *minus* sign (−) signifies *below* the average.

HAY HARVEST FORECASTS, 1885.

"Sir,

"I beg to submit herewith a report on the Hay Harvest Forecasts for 1885.

"The issue of the forecasts commenced on June 15th, with those for England E., the Midland Counties and England, S., and as the time advanced those for other districts were added. The forecasts were issued daily (excepting on Sundays), and in most instances they were sent for about five weeks. In two or three cases, however, they were continued until the close of the wheat harvest; the additional expense of this extension was borne in one instance (Knutsford) by Lord Egerton of Tatton.

"It was scarcely probable that the high percentage of success noticed last year in England, E., and England, S., would be maintained, but the result of this year's checking shows that while, owing to a falling off in the number of *partial* successes, the general percentage was a little lower than in the two preceding years, the proportion of *completely* successful forecasts (56 per cent.) was much greater than in any year since the institution of the service. The largest general percentage (88) was reached in Scotland, N., Scotland, E., England, E., and England S., while the smallest (74) was in Scotland, W., and England, N.W.

"The following is a brief *résumé* of the larger table appended to this report:—

"Summary of Results.

Districts.	Names of Stations.	Percentages.				Total Percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
Scotland, N. ..	Golspie and Munlochy ..	48	40	6	6	88
Scotland, E. ..	Grange, Glamis, Aberfeldy, and Longniddry	57	31	11	1	88
England, N.E. ..	Chatton and Ulceby ..	60	18	19	3	78
England, E. ..	Thorpe, Ditchingham, and Rothamsted	64	24	10	2	88
Midland Counties	Cirencester and Gerrard's Cross	63	23	12	2	86
England, S. ..	Maidstone and Downton	60	28	12	..	88
Scotland, W. ..	Dumbarton, Islay, and Stranraer	51	23	21	5	74
England, N.W. ..	Leyburn, Prescot, and Knutsford	51	23	21	5	74
England, S.W. ..	Bridgend, (Glamorgan), Falfield, Clifton, and Glastonbury	63	24	11	2	87
Ireland, N... ..	Antrim, Moynalty, and Hollymount	49	27	17	7	76
Ireland, S.	Moneygall, Kilkenny, and Ardfert	50	27	18	5	77
	Mean for all districts..	56	26	15	3	82

"Two features in the forecast service of the year are deserving of special mention. The first of these was the establishment at Ditchingham, in Norfolk, of a system of weather signalling by means of which the terms of the forecasts were made known over a considerable area. The signals consisted of a ball, a drum, and a double cone, and were hoisted at about 5·30 P.M. each day, on the summit of Ditchingham Church tower, and remained up until the forenoon of the following day. The entire arrangements were organised, and the expenses arranged for by F. Morrice, Esq., of Ditchingham Hall, who at the close of the time wrote as follows :—'The *signals* caused a wide difference of opinion as to their utility, and some fierce opposition. On the whole I think they were a great success. During the last week I shall call a meeting of farmers and others interested, and if they agree, I hope another year to extend the system considerably, paying for our own telegrams by subscription, and copying from one church tower to another.' (M.O. 1879.) After a severe analysis of the *forecasts*, Mr. Morrice reported that 72 per cent. (or, omitting the last week, 77 per cent.) were *right*; this result is even more satisfactory than that obtained by our own system of checking.

"The other feature of interest in connection with the service was the fact that there were this year as many as four subscribers for the forecasts, one in England, E., two in the Midland counties, and one in England, N.W. At the close of the time these persons were unanimous in their testimony to the success and value of the system. The subscribers in England, E. (Mr. Fergusson), wrote :—'There has not been one mistake during the time I have had them.' (M.O. 1512.) From the Midland counties one of the recipients (Mr. Harcourt Vernon) wrote :—'My agent informs me that they were wonderfully accurate, and of the greatest help to him and those of my tenants who live near enough to use them.' (M.O. 1868.) The other subscriber in this district (Lord Vernon) gave practical proof of his appreciation of the forecasts by depositing with the office at the close of the time a sum of money sufficient to defray the cost of similar telegrams next year. The subscriber in England, N.W. (Mr. Earle), remarked that the forecasts had 'answered every purpose.' (M.O. 1511.)

"The opinions of Mr. Jacob Wilson, Mr. Birkbeck, and Mr. Farrell, quoted in the larger table, are worthy of note.

"I am, &c.,

(Signed) "FREDC. GASTER.

" *To* R. H. SCOTT, ESQ.,

" *Secretary, Meteorological Council.*"

HAY HARVEST

Return showing the Number of Forecasts sent to each
otherwise of

Districts.	To whom sent.	Address.
0. Scotland, N. ..	D. Melville, for the Rev. Dr. Joass ..	Dunrobin Gardens, Golspie
	Major Smith	Munlochy, Inverness .. ..
1. Scotland, E. ..	A. F. Leslie .. .	Braes Grange, Banffshire ..
	G. Johnston	The Gardens, Glamis, Forfar
	C. W. L. Forbes ..	Aberfeldy .. ..
	W. S. Macdonald ..	Craigielaw, Longniddry ..
2. England, N.E. ..	J. Wilson	Chillingham Barnes, Chatton, Northumberland .. ..
	J. Turner	The Grange, Ulceby .. ..
3. England, E. ..	W. Birkbeck	High House, Thorpe, Norwich
	F. Morrice	Ditchingham Hall, Bungay
	Sir J. B. Lawes, Bart.	Rothamsted, Harpenden ..
4. Midland Counties	Professor Ohm	Royal Agricultural College, Cirencester .. ..
	C. King, for the Duke of Somerset	Gerrard's Cross, Bucks ..
5. England, S. ..	C. Whitehead	Barming House, Maidstone ..
	E. P. Squarey	The Moot, Downton, Wilts ..
6. Scotland, W. ..	W. Calder	Castle Hill, Dalreock, Dumbarton .. ..
	J. S. R. Ballingal ..	Eallabus, Bridgend, Islay
	M. J. Stewart	Ardwell, Stranaer .. ..
7. England, N.W...	G. W. Wray	Leyburn, Yorkshire .. ..
	F. Harrison, for the Earl of Derby ..	Knowsley, Prescot .. .. ..
	J. F. Smith, for Lord Egerton of Tatton	Tatton Park, Knutsford ..
8. England, S.W. ..	Colonel T. P. Turberville	Ewenny Priory, Bridgend, Glamorgan .. .. ..
	J. Harle, for the Earl of Ducie	Whitfield, Falfield, R.S.O. ..
	T. Dyke	Long Ashton, Clifton, Bristol
	R. Neville	Butleigh Court, Glastonbury
9. Ireland, N. ..	J. B. Johnstone ..	Antrim Castle, Antrim .. ..
	E. F. Farrell	Moynalty Kells .. .. ..
	Rev. A. Brown	The Manse, Hollymount ..
0. Ireland, S.	D. A. M'Cready ..	Larchvale, Moneygall .. ..
	D. A. Milward	Lavistown, Kilkenny .. ..
	W. Talbot Crosbie ..	Ardfert Abbey, Ardfert ..

FORECASTS, 1885.

OF THE UNDERMENTIONED PERSONS, WITH THE SUCCESS OR THE FORECASTS.

No. of Forecasts sent.	No. of Forecasts checked.	Percentages.				Remarks.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
33	21	47·6	38·1	4·8	9·5	
33	33	48·5	42·4	6·1	3·0	
30	30	53·3	40·0	6·7	..	
30	30	56·7	26·7	13·3	3·3	
30	30	60·0	26·7	13·3	..	
30	24	58·3	29·2	12·5	..	
54	54	57·4	18·5	20·4	3·7	Mr. Jacob Wilson remarks "they are very much appreciated in my neighbourhood."
30	30	63·3	16·7	16·7	3·3	
30	30	53·4	30·0	13·3	3·3	Mr. W. Birkbeck reports that with few exceptions the forecasts were "very accurate."
50	50	60·0	30·0	6·0	4·0	
30	18	77·8	11·1	11·1	..	
30	30	63·4	23·3	10·0	3·3	
30	30	63·4	23·3	13·3	..	
30	30	70·0	16·7	13·3	..	
30	30	50·0	40·0	10·0	..	
30	30	53·4	23·3	23·3	..	
30	28	46·5	21·4	21·4	10·7	
30	30	53·4	23·3	20·0	3·3	
30	30	63·3	16·7	16·7	3·3	
24	24	50·0	20·8	29·2	..	
78	78	41·0	32·0	16·7	10·3	
30	30	53·4	40·0	3·3	3·3	
30	30	70·0	13·3	16·7	..	
30	29	69·0	13·8	13·8	3·4	
30	30	60·0	26·7	10·0	3·3	
30	18	55·6	27·8	11·1	5·5	M. E. F. Farrell, in asking for a continuance of the forecasts, says "they have been most useful in regulating farming operations."
40	40	50·0	22·5	17·5	10·0	
30	30	40·0	30·0	23·3	6·7	
30	30	43·3	30·0	16·7	10·0	
30	29	55·2	20·7	24·1	..	
30	30	50·0	30·0	13·3	6·7	

CORN: Importations, Sales, and Prices.

Table V.—Quantities of Wheat, Wheatmeal, and Flour, Barley, Oats, Peas and Beans, Imported into the United Kingdom in the Year 1885.

1885.	Wheat.	Wheatmeal and Flour.	Barley.	Oats.	Peas.	Beans.
	cwts.	cwts.	cwts.	cwts.	cwts.	cwts.
January ..	4,360,400	1,700,236	1,426,341	760,818	147,766	294,678
February	3,677,663	1,318,449	1,019,459	518,816	111,728	280,520
March ..	3,575,884	1,536,690	1,041,478	907,585	134,503	205,741
April ..	5,316,059	1,604,579	787,104	1,252,428	88,446	159,331
May ..	5,732,470	1,888,975	2,277,575	1,715,085	196,424	249,952
June ..	7,063,719	1,344,950	1,420,206	1,431,995	269,922	386,601
In first Six Months	29,726,195	9,393,879	7,972,163	6,586,727	948,789	1,576,823
July	7,002,711	1,244,705	1,174,308	1,145,810	135,455	464,283
August ..	5,232,150	775,641	716,675	1,204,687	96,319	315,506
September	6,318,233	929,892	1,333,167	1,174,897	149,739	378,881
October ..	4,652,664	1,104,760	1,531,141	1,200,022	152,210	314,989
November	3,966,535	1,167,145	1,336,690	1,015,109	301,509	178,679
December	4,555,313	1,219,170	1,327,541	734,559	219,541	285,503
In last Six Months	31,727,606	6,441,313	7,419,522	6,475,084	1,054,773	1,937,841
Year ..	61,453,801	15,835,192	15,391,685	13,061,811	2,003,562	3,514,664

Note.—The average weights *per quarter* of corn, as adopted in the office of the Inspector-General of Imports and Exports, are as follow:—For wheat, 485⅓ lbs., or 4⅓ cwts.; for barley, 400 lbs., or 3⁴⁄₇ cwts.; for oats, 308 lbs., or 2¾ cwts. Corn has been entered by *weight* instead of *measure* since September, 1864. No duty has been charged since 1st June, 1869.

Table VI.—Computed Real Value of Corn Imported into the United Kingdom in each of the Seven Years, 1879-85.

	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	£.	£.	£.	£.	£.	£.	£.
Wheat ..	31,329,500	30,604,285	31,466,804	34,237,099	31,434,888	19,825,021	24,066,013
Barley ..	4,798,923	4,998,442	4,069,402	5,541,498	5,784,504	4,228,722	4,528,823
Oats ..	4,500,760	4,946,440	3,781,013	4,603,983	5,043,011	4,195,514	4,252,135
Maize ..	9,802,249	11,141,642	10,392,460	6,522,070	10,314,307	7,303,099	8,473,863
Other kinds	1,634,064	1,920,787	1,617,820	1,637,282	2,114,289	1,820,366	1,758,105
Wheat Flour	8,505,308	8,721,269	9,205,807	10,631,933	12,318,144	10,166,010	9,651,508
Other kinds of Flour	25,585	36,845	24,007	21,966	31,038	23,970	18,811
Total of Corn ..	60,596,389	62,369,710	60,557,313	63,195,831	67,040,181	47,562,702	52,749,258

Table VII.—Quantities of British Wheat Sold in the Towns from which Returns are received under the Act of the 27th & 28th Victoria, cap. 87, and their Average Prices, in each of the Twelve Months of the Years 1879–85.

	Quantities in Quarters.						
	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	quarters.	quarters.	quarters.	quarters.	quarters.	quarters.	quarters.
First month ..	183,223	124,422	122,533	181,182	178,386	200,335	252,271
Second month	237,861	142,857	119,219	175,829	214,412	214,935	257,613
Third month (five weeks)	234,469	136,613	164,942	169,155	276,485	289,987	256,861
Fourth month	197,918	106,170	120,177	142,321	228,550	189,663	194,853
Fifth month ..	227,295	104,125	130,235	143,861	271,744	245,637	206,924
Sixth month (five weeks)	229,307	127,132	113,386	112,818	248,770	180,893	200,421
Seventh month	105,139	71,622	57,333	51,130	129,768	113,424	133,407
Eighth month	71,525	54,641	49,329	42,363	150,769	132,773	139,177
Ninth month (five weeks)	75,374	153,752	197,351	229,765	291,157	358,231	268,689
Tenth month	96,261	197,757	231,960	217,416	289,858	291,763	295,065
Eleventh month	156,218	172,153	194,080	192,704	278,749	257,483	232,891
Twelfth month (five weeks)	207,511	218,641	215,547	245,290	342,517	310,903	303,318

	Average Prices per Quarter.						
	1879.	1880.	1881.	1882.	1883.	1884.	1885.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
First month ..	39 3	46 2	42 7	45 8	40 3	38 8	33 5
Second month	38 0	44 0	41 10	46 0	41 0	37 4	33 4
Third month (five weeks)	39 7	56 5	42 11	44 9	42 4	37 7	31 11
Fourth month	41 0	48 2	44 8	46 2	41 11	37 5	34 2
Fifth month ..	40 10	45 4	44 6	47 4	43 2	37 10	37 1
Sixth month (five weeks)	41 8	45 1	44 9	47 4	42 10	37 2	33 9
Seventh month	44 6	43 9	46 8	48 10	42 2	37 0	33 8
Eighth month	49 4	44 0	48 7	50 0	43 7	37 5	33 6
Ninth month (five weeks)	47 7	41 9	51 4	44 0	41 10	34 0	31 8
Tenth month ..	48 10	41 4	47 0	39 8	40 5	32 4	30 11
Eleventh month	49 4	43 7	45 11	40 10	40 3	31 8	31 1
Twelfth month (five weeks)	46 7	44 2	44 7	41 5	39 7	31 0	30 7

TABLE VIII.—AVERAGE PRICES of BRITISH CORN per Quarter (Imperial measure) as received from the INSPECTORS and OFFICERS of EXCISE according to the Act of 27th & 28th VICTORIA, cap. 87, in each of the FIFTY-TWO WEEKS of the YEAR 1885.

Week ending	Wheat.		Barley.		Oats.		Week ending	Wheat.		Barley.		Oats.	
	s.	d.	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.
January 3..	31	11	31	4	19	6	July 4..	33	3	28	0	22	7
January 10..	32	7	31	7	19	11	July 11..	33	8	28	8	22	4
January 17..	34	2	32	3	20	1	July 18..	33	11	29	11	22	1
January 24..	34	11	32	5	20	4	July 25..	33	11	29	0	21	8
January 31..	34	6	32	1	20	6	August 1..	34	1	27	0	22	6
February 7..	33	9	32	5	20	11	August 8..	33	6	27	11	23	6
February 14..	32	10	31	9	20	11	August 15..	33	1	24	10	21	11
February 21..	32	4	31	10	20	8	August 22..	33	5	26	2	20	11
February 28..	32	0	31	6	20	3	August 29 ..	33	3	28	4	20	6
March 7..	31	8	31	3	20	8	September 5	32	4	30	7	20	0
March 14..	31	4	31	3	20	9	September 12	31	1	31	11	19	1
March 21..	31	11	31	2	20	8	September 19	30	10	31	1	19	2
March 28..	32	7	31	4	20	10	September 26	30	10	31	0	19	4
Average of Winter Quarter	32	9	31	8	20	5	Average of Summer Quarter	32	10	28	9	21	2
April 4..	32	6	31	6	20	9	October 3..	30	6	31	1	19	1
April 11..	33	3	31	2	20	11	October 10..	30	7	30	11	18	8
April 18..	34	1	31	3	20	11	October 17..	30	11	30	9	18	9
April 25..	36	8	32	6	22	9	October 24..	31	6	30	7	18	9
May 2..	37	1	31	4	22	7	October 31..	31	4	30	2	19	2
May 9..	38	1	30	4	23	2	November 7	31	1	30	3	18	11
May 16..	37	5	30	8	22	10	November 14	31	0	30	4	19	0
May 23..	35	10	28	11	22	6	November 21	30	10	29	9	18	3
May 30..	34	11	28	8	22	9	November 28	30	9	29	5	18	7
June 6..	34	6	27	6	22	3	December 5	31	0	30	1	18	10
June 13..	33	8	30	2	22	1	December 12	30	5	29	8	18	2
June 20..	33	2	28	2	22	4	December 19	30	5	29	3	18	1
June 27..	32	8	28	3	22	4	December 26	30	2	29	0	18	3
Average of Spring Quarter	34	10	30	0	22	2	Average of Autumn Quarter	30	9	30	1	18	7

TABLE IX.—QUANTITIES of WHEAT, BARLEY, OATS, PEAS, BEANS, INDIAN CORN or MAIZE, WHEATMEAL, and FLOUR, IMPORTED in the FIVE YEARS 1881–85; also the COUNTRIES from which the WHEAT, WHEATMEAL, and FLOUR were obtained.

	1881.	1882.	1883.	1884.	1885.
Wheat from—	cwts.	cwts.	cwts.	cwts.	cwts.
Russia	4,018,895	9,571,021	13,293,358	5,401,964	11,986,359
Denmark	*	*	*	*	*
Germany	1,361,724	3,083,921	2,871,095	1,090,368	1,982,772
France	6,693	7,379	9,498	19,023	2,662
Turkey and Roumania ..	248,387	721,030	1,532,011	504,613	1,062,901
Egypt	1,070,488	174,862	1,174,391	999,578	109,983
United States	36,038,074	35,059,623	26,065,832	22,606,130	24,278,719
Chili	1,091,803	1,656,361	2,310,126	1,055,964	1,623,215
British India	7,308,842	8,477,479	11,243,497	8,009,909	12,101,963
Australia	2,978,130	2,475,127	2,691,614	4,897,766	5,279,230
British North America ..	2,860,854	2,684,828	1,798,056	1,757,406	1,745,542
Other countries	58,779	259,991	1,090,966	771,277	1,280,455
Total Wheat ..	57,042,669	64,171,622	64,080,444	47,113,998	61,453,801
Barley	9,811,051	15,519,850	16,593,784	12,987,293	15,391,685
Oats	10,336,795	13,646,151	15,248,467	12,936,189	13,061,811
Peas	1,972,724	2,100,197	1,879,618	1,935,432	2,003,562
Beans	2,070,199	2,074,293	3,578,121	3,519,550	3,514,664
Indian Corn, or Maize ..	33,429,722	18,255,285	31,538,952	24,794,624	31,467,638
Wheatmeal and Flour from—					
Germany	1,388,218	1,990,403	1,928,769	1,746,514	1,415,046
France	203,296	220,269	163,898	154,349	187,097
United States	7,696,415	7,777,262	11,270,918	10,340,567	11,728,468
British North America ..	260,342	339,305	469,460	688,925	280,479
Other countries	1,812,139	2,701,466	2,460,484	2,173,163	2,224,102
Total Wheatmeal and Flour	11,360,410	13,028,705	16,293,529	15,103,518	15,835,192
Indian Corn Meal	25,137	16,422	35,817	16,062	13,722

* Included under "Other Countries."

TABLE X.—AVERAGE PRICES of Consols, of Wheat, and of Meat; also the AVERAGE NUMBER of PAUPERS relieved on the *last day* of each Week; and the MEAN TEMPERATURE, in each of the Twelve Quarters ending December 31st, 1885.

Quarters ending	AVERAGE PRICES.						PAUPERISM.		Mean Temperature.
	Consols (for Money).	Average Minimum Rate per Cent. of Discount charged by Bank of England.	Wheat per Quarter in England and Wales.		Meat per lb. at the Metropolitan Meat Market (by the Carcass).		Quarterly Average of the Number of Paupers relieved on the *last day* of each week.		
					Beef.	Mutton.	In-door.	Out-door.	
	£.		s.	d.					°
1883 Mar. 31	102	3·84	41	3	5$\frac{1}{8}$*d.*—8$\frac{1}{8}$*d.* Mean 6$\frac{5}{8}$*d.*	5$\frac{7}{8}$*d.*—10$\frac{1}{8}$*d.* Mean 8*d.*	189,391	558,064	40·0
June 30	102$\frac{1}{8}$	3·57	42	8	5*d.*—8*d.* Mean 6$\frac{4}{8}$*d.*	5$\frac{6}{8}$*d.*—9$\frac{4}{8}$*d.* Mean 7$\frac{5}{8}$*d.*	172,858	537,495	53·0
Sept. 30	100$\frac{1}{8}$	3·88	42	5	5*d.*—8$\frac{3}{8}$*d.* Mean 6$\frac{6}{8}$*d.*	5$\frac{6}{8}$*d.*—10*d.* Mean 7$\frac{7}{8}$*d.*	165,263	519,260	59·5
Dec. 31	101$\frac{4}{8}$	3·00	40	0	4$\frac{6}{8}$*d.*—8*d.* Mean 6$\frac{3}{8}$*d.*	5$\frac{3}{8}$*d.*—9$\frac{4}{8}$*d.* Mean 7$\frac{4}{8}$*d.*	178,715	518,070	44·9
1884 Mar. 31	101$\frac{6}{8}$	3·19	37	9	4$\frac{4}{8}$*d.*—7$\frac{6}{8}$*d.* Mean 6$\frac{1}{8}$*d.*	5*d.*—8$\frac{6}{8}$*d.* Mean 6$\frac{7}{8}$*d.*	186,636	536,767	43·4
June 30	101$\frac{7}{8}$	2·42	37	6	4$\frac{4}{8}$*d.*—7$\frac{5}{8}$*d.* Mean 6$\frac{1}{8}$*d.*	5$\frac{1}{8}$*d.*—9*d.* Mean 7*d.*	173,749	523,182	52·5
Sept. 30	100$\frac{6}{8}$	2·00	35	11	4$\frac{3}{8}$*d.*—7$\frac{6}{8}$*d.* Mean 6$\frac{1}{8}$*d.*	4$\frac{7}{8}$*d.*—8$\frac{7}{8}$*d.* Mean 6$\frac{7}{8}$*d.*	168,076	513,981	62·7
Dec. 31	100$\frac{6}{8}$	4·17	31	7	4$\frac{1}{8}$*d.*—7$\frac{4}{8}$*d.* Mean 5$\frac{7}{8}$*d.*	4$\frac{5}{8}$*d.*—8*d.* Mean 6$\frac{3}{8}$*d.*	181,776	518,811	44·1
1885 Mar. 31	98$\frac{7}{8}$	4·24	32	9	4*d.*—7*d.* Mean 5$\frac{4}{8}$*d.*	4$\frac{2}{8}$*d.*—7$\frac{4}{8}$*d.* Mean 5$\frac{7}{8}$*d.*	189,718	546,688	40·3
June 30	98$\frac{2}{8}$	2·75	34	10	4$\frac{2}{8}$*d.*—6$\frac{6}{8}$*d.* Mean 5$\frac{4}{8}$*d.*	4$\frac{7}{8}$*d.*—8$\frac{1}{8}$*d.* Mean 6$\frac{4}{8}$*d.*	173,498	524,628	52·4
Sept. 30	99$\frac{7}{8}$	2·00	32	10	3$\frac{6}{8}$*d.*—6$\frac{6}{8}$*d.* Mean 5$\frac{2}{8}$*d.*	4$\frac{3}{8}$*d.*—7$\frac{6}{8}$*d.* Mean 6*d.*	167,185	513,326	59·1
Dec. 31	100	2·68	30	9	3$\frac{3}{8}$*d.*—6$\frac{6}{8}$*d.* Mean 5$\frac{1}{8}$*d.*	3$\frac{4}{8}$*d.*—7*d.* Mean 5$\frac{3}{8}$*d.*	183,503	528,885	42·8

1885.—WEEKLY AVERAGE PRICE OF **WHEAT** FROM GOVERNMENT RETURNS.

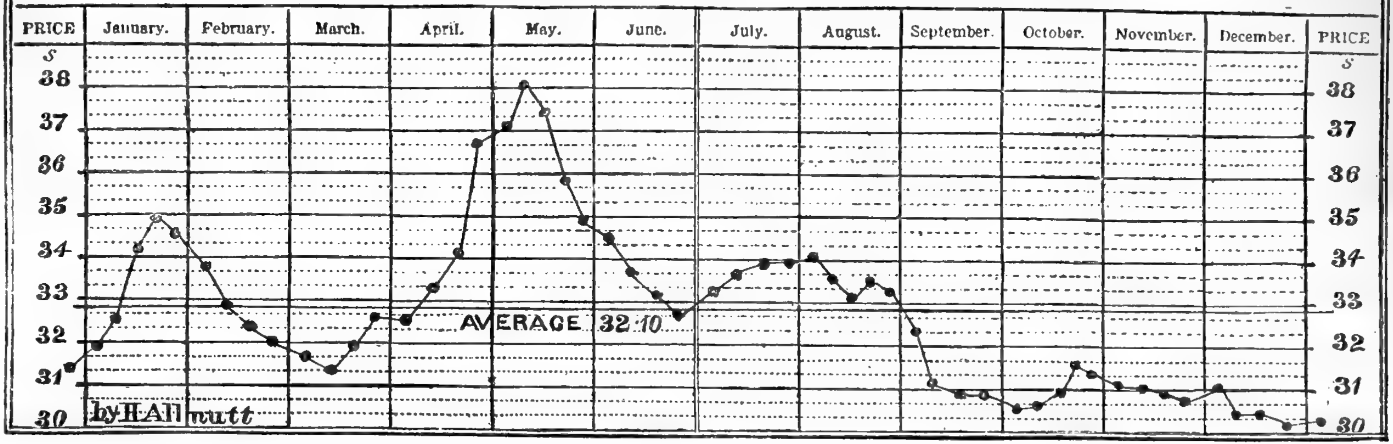


TABLE XI.—ACREAGE under each Description of CROP, FALLOW, and IRELAND,

DESCRIPTION of CROPS and LIVE STOCK.	GREAT BRITAIN.		
	1883.	1884.	1885.
CORN CROPS:—	Acres.	Acres.	Acres.
Wheat	2,613,162	2,677,038	2,478,318
Barley or Bere	2,291,991	2,168,820	2,257,346
Oats	2,975,381	2,915,363	2,940,490
Rye	50,768	47,040	50,839
Beans	447,934	446,824	434,653
Peas	239,439	229,645	230,360
TOTAL CORN CROPS	8,618,675	8,484,730	8,392,006
GREEN CROPS:—			
Potatoes	543,455	565,048	548,731
Turnips and Swedes	2,028,926	2,027,610	2,014,958
Mangold and Beetroot	329,937	327,364	354,523
Carrots and Parsnips	13,338	13,587	16,600
Cabbage, Kohl-rabi, and Rape	146,102	146,946	153,079
Vetches, Lucerne, and any other crop (except clover or grass)	392,821	407,148	433,711
TOTAL GREEN CROPS	3,454,579	3,487,703	3,521,602
OTHER CROPS, GRASS, &c.:—			
Flax	4,317	2,247	2,490
Hops	68,016	69,258	71,327
Bare fallow or uncropped arable land	778,203	749,699	560,342
Clover and artificial and other grasses under rotation	4,395,922	4,381,404	4,654,173
Permanent pasture, meadow, or grass not broken up in rotation (exclusive of heath or mountain land)	15,065,373	15,290,820	15,342,478
LIVE STOCK:—	No.	No.	No.
Cattle	5,962,779	6,269,141	6,597,964
Sheep	25,068,271	26,068,354	26,534,635
Pigs	2,617,757	2,584,391	2,403,380
Total number of horses used for agriculture, unbroken horses, and mares kept solely for breeding	1,410,596	1,414,377	1,408,789

and GRASS, and NUMBER of CATTLE, SHEEP, and PIGS, in GREAT BRITAIN in 1883-85.

IRELAND.			UNITED KINGDOM, including the Islands.		
1883.	1884.	1885.	1883.	1884.	1885.
Acres.	Acres.	Acres.	Acres.	Acres.	Acres.
94,802	69,008	70,874	2,713,282	2,750,588	2,553,092
184,015	167,346	179,778	2,486,137	2,346,041	2,447,169
1,380,871	1,347,395	1,327,982	4,370,076	4,276,866	4,282,594
7,250	7,152	8,383	58,082	54,234	59,301
10,250	7,756	6,401	458,440	454,839	441,267
937	972	739	240,501	230,696	231,202
1,678,125	1,599,629	1,594,157	10,326,518	10,113,264	10,014,625
806,664	798,942	797,103	1,359,726	1,373,835	1,355,922
306,767	304,031	296,902	2,346,216	2,342,577	2,322,387
37,908	34,512	37,141	368,811	363,031	392,907
3,436	3,139	3,035	17,184	17,062	20,040
41,489	45,346	47,887	187,685	192,397	201,283
33,989	35,443	36,793	429,312	444,958	472,656
1,230,253	1,221,413	1,218,861	4,708,934	4,733,860	4,765,195
95,935	89,197	108,149	100,262	91,444	110,639
..	..	..	68,016	69,259	71,327
24,698	23,560	19,075	803,225	773,542	579,707
1,931,101	1,962,730	2,032,861	6,371,799	6,392,402	6,738,206
10,191,118	10,346,308	10,245,927	25,288,520	25,667,206	25,616,071
No.	No.	No.	No.	No.	No.
4,096,021	4,112,267	4,228,751	10,097,943	10,422,762	10,868,760
3,219,098	3,243,572	3,477,840	28,347,560	29,376,787	30,086,200
1,351,990	1,306,195	1,269,122	3,986,427	3,906,205	3,686,628
478,912	480,846	491,147	1,898,745	1,904,515	1,909,200

TABLE XII.—NUMBER of BEASTS exhibited and the PRICES realised for them at the CHRISTMAS MARKETS since 1844.

Year.	Beasts.	Prices.	Year.	Beasts.	Prices.
		s. d. s. d.			s. d. s. d.
1844	5,713	4 0—4 6	1865	7,530	3 4—5 4
1845	5,326	3 6—4 8	1866	7,340	3 8—5 6
1846	4,570	4 0—5 8	1867	8,110	3 4—5 0
1847	4,282	3 4—4 8	1868	5,320	3 4—5 8
1848	5,942	3 4—4 8	1869	6,728	3 6—6 2
1849	5,765	3 4—4 0	1870	6,425	3 6—6 2
1850	6,341	3 0—3 10	1871	6,320	3 10—6 2
1851	6,103	2 8—4 2	1872	7,560	3 8—6 0
1852	6,271	2 8—4 0	1873	6,170	4 4—6 6
1853	7,037	3 2—4 10	1874	6,570	4 4—6 8
1854	6,181	3 6—5 4	1875	7,660	4 6—6 6
1855	7,000	3 8—4 2	1876	7,020	4 4—6 4
1856	6,748	3 4—5 0	1877	7,510	4 6—6 0
1857	6,856	3 4—4 8	1878	6,830	4 6—6 0
1858	6,424	3 4—5 0	1879	5,620	4 0—6 4
1859	7,560	3 6—5 4	1880	7,660	4 0—6 0
1860	7,860	3 4—5 6	1881	8,150	4 0—6 2
1861	8,840	3 4—5 0	1882	7,370	4 6—6 4
1862	8,430	3 4—5 0	1883	5,940	4 0—6 4
1863	10,372	3 6—5 2	1884	5,300	4 0—6 2
1864	7,130	3 8—5 8	1885	7,550	3 6—5 4

TABLE XIII.—AVERAGE PRICES of BRITISH WHEAT, BARLEY, and OATS, per IMPERIAL QUARTER, in each of the TWENTY YEARS 1866–85.

Year.	Wheat.	Barley.	Oats.	Year.	Wheat.	Barley.	Oats.
	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.
1866	49 11	37 5	24 7	1876	46 2	35 2	26 3
1867	64 5	40 0	26 1	1877	56 9	39 8	25 11
1868	63 9	43 0	28 1	1878	46 5	40 2	24 4
1869	48 2	39 5	26 0	1879	43 10	34 0	21 9
1870	46 11	34 7	22 10	1880	44 4	33 1	23 1
1871	56 8	36 2	25 2	1881	45 4	31 11	21 9
1872	57 0	37 4	23 2	1882	45 1	31 2	21 10
1873	58 8	40 5	25 5	1883	41 7	31 10	21 5
1874	55 9	44 11	28 10	1884	35 8	30 8	20 3
1875	45 2	38 5	28 8	1885	32 10	30 1	20 7

TABLE XIV.—CERTAIN ARTICLES of FOREIGN and COLONIAL PRODUCTION IMPORTED in the YEARS 1882–85; and their QUANTITIES.

	1882.	1883.	1884.	1885.
ANIMALS, Living:				
Oxen, Bulls, and Cows, number	309,360	427,445	371,010	327,254
Calves .. .. ,,	34,340	47,117	54,492	45,861
Sheep .. .. ,, } Lambs .. .. ,, }	1,124,391	1,115,695	945,043	750,927
Swine and Hogs .. .. ,,	15,670	38,863	26,441	16,522
Bones (burnt or not, or as animal charcoal) .. .. tons	54,401	73,948	72,640	64,140
Cotton, Raw .. .. .. cwts.	15,794,566	15,367,874	15,505,851	12,586,009
Flax .. .. ,,	1,966,969	1,546,931	1,606,966	1,664,836
Guano .. .. tons	45,095	73,962	48,284	24,757
Hemp .. .. cwts.	1,354,407	1,440,554	1,334,924	1,446,398
Hops .. .. ,,	315,377	125,349	257,374	266,473
Hides untanned: Dry .. ,,	576,451	634,355	646,842	672,878
,, ,, Wet .. ,,	613,593	562,767	572,189	555,114
	gallons.	gallons.		
Petroleum .. .. tuns	59,135,384	70,185,563	52,808,436	73,869,787
Oilseed Cakes .. .. .. tons	190,252	257,445	269,235	283,052
Potatoes .. .. cwts.	2,997,514	5,149,891	2,444,073	2,300,824
Butter .. .. ,,	2,167,428	2,332,701	2,472,567	2,400,565
Cheese .. .. ,,	1,692,495	1,797,080	1,926,070	1,833,050
Eggs .. .. .. great hundreds	6,757,234	7,826,674	8,275,553	8,351,306
Lard .. .. cwts.	665,885	852,150	698,397	869,842
Clover Seeds .. .. .. ,,	354,869	317,211	290,022	315,803
Flax-seed and Linseed .. qrs.	2,437,918	2,337,867	1,805,535	2,056,263
Rape .. .. ,,	547,679	775,358	769,813	544,275
Sheep and Lambs' Wool .. lbs.	483,954,318	494,110,743	519,555,493	501,182,161

TABLE XV.—QUANTITY and VALUE of BUTTER IMPORTED from DENMARK, 1866–84.

Years.	Quantities.	Computed Real Value.	Years.	Quantities.	Computed Real Value.
	Cwts.	£.		Cwts.	£.
1866	67,305	319,528	1875	206,171	1,275,870
1867	80,589	422,479	1876	205,195	1,311,234
1868	79,437	471,262	1877	210,322	1,347,791
1869	103,613	574,981	1878	242,427	1,517,467
1870	127,013	767,190	1879	281,740	1,673,452
1871	140,851	803,226	1880	300,157	1,777,176
1872	173,574	1,009,322	1881	279,625	1,691,894
1873	201,558	1,203,459	1882	304,732	1,850,586
1874	226,053	1,363,433	1883	353,584	2,151,730
			1884	335,067	2,008,451

TABLE XVI.—QUANTITY and VALUE of DEAD MEAT IMPORTED in the 3 YEARS, 1883–5.

DEAD MEAT.		QUANTITIES.			VALUES.		
		1883.	1884.	1885.	1883.	1884.	1885.
		Cwts.	Cwts.	Cwts.	£	£	£
BACON:—							
From United States		2,431,395	1,917,243	2,452,076	6,173,753	4,353,797	4,472,262
,, Other Countries		648,767	838,661	716,374	2,004,370	2,430,648	1,955,710
Total		3,080,162	2,755,904	3,168,450	8,178,123	6,784,445	6,427,972
BEEF:—							
Salted	From United States	279,115	203,682	233,031	610,137	403,552	442,739
	,, Other Countries	7,693	7,298	7,566	18,110	14,879	15,443
Total		286,808	210,980	240,597	628,247	418,431	458,182
Fresh	From United States	726,856	809,558	852,210	2,047,973	2,202,032	2,217,196
	,, Other Countries	73,890	66,706	49,979	202,044	170,393	125,628
Total		800,746	876,264	902,189	2,250,017	2,372,425	2,342,824
HAMS:—							
From United States		561,137	574,447	782,551	1,693,834	1,695,280	1,984,471
,, Other Countries		40,888	78,579	94,348	129,518	236,211	251,922
Total		602,025	653,026	876,899	1,823,352	1,931,491	2,236,393
MEAT, Unenumerated:—							
Salted or Fresh	From United States	633	2,006	2,811	1,361	4,083	5,198
	,, Other Countries	35,826	17,512	27,352	110,594	58,990	80,572
Total		36,459	19,518	30,163	111,955	63,073	85,770
Preserved, otherwise than by Salting	From Australasia	226,059	127,561	198,279	537,616	309,197	473,364
	,, United States	308,303	259,632	261,257	831,678	714,115	690,552
	,, Other Countries	74,973	61,851	67,191	382,290	368,995	370,261
Total		609,335	449,044	526,727	1,751,584	1,392,307	1,534,177
MUTTON, FRESH:—							
From Holland		83,414	116,182	80,785	262,442	372,346	240,259
,, Australasia		104,714	303,203	336,495	294,376	820,263	833,990
,, Other Countries		49,490	82,989	154,366	142,884	215,901	409,201
Total		237,618	502,374	571,646	699,702	1,408,510	1,483,450
PORK:—							
Salted, (not Hams)	From United States	247,056	179,772	221,967	490,465	307,479	332,255
	,, Other Countries	81,712	98,571	89,944	144,815	159,522	170,661
Total		328,768	278,343	311,911	635,280	467,001	502,916
Fresh	From United States	131	192	889	277	369	1,545
	,, Other Countries	47,215	58,587	69,084	124,094	152,002	181,912
Total		47,346	58,779	69,973	124,371	152,371	183,457
TOTAL OF DEAD MEAT		6,029,267	5,804,232	6,698,555	16,202,631	14,990,054	15,255,141

TABLE XVII.—QUANTITY and VALUE of BUTTER Imported from the UNITED STATES, BELGIUM, FRANCE and HOLLAND; and of CHEESE Imported from the UNITED STATES and HOLLAND, 1870–84.

Years.	UNITED STATES.			
	BUTTER.		CHEESE.	
	Quantities.	Computed Real Value.	Quantities.	Computed Real Value.
	Cwts.	£.	Cwts.	£.
1870 ..	16,915	80,928	555,385	1,861,263
1871 ..	83,775	394,359	731,326	2,014,805
1872 ..	45,765	199,679	598,198	1,701,435
1873 ..	43,406	199,639	790,238	2,353,181
1874 ..	36,307	188,769	849,933	2,589,776
1875 ..	40,331	205,900	958,978	2,786,027
1876 ..	118,131	593,122	936,203	2,564,977
1877 ..	188,491	920,561	1,082,844	3,129,829
1878 ..	219,794	998,766	1,345,745	3,306,612
1879 ..	301,054	1,243,075	1,214,959	2,467,651
1880 ..	277,790	1,343,967	1,171,498	3,411,625
1881 ..	174,246	845,125	1,244,419	3,555,702
1882 ..	51,246	250,764	969,502	2,711,259
1883 ..	120,163	562,318	990,963	2,695,704
1884 ..	100,281	448,556	976,190	2,479,908

Years.	BELGIUM.—BUTTER.		FRANCE.—BUTTER.	
	Cwts.	£.	Cwts.	£.
1870 ..	84,408	516,643	289,692	1,672,899
1871 ..	94,539	523,460	304,683	1,636,006
1872 ..	74,191	409,555	355,089	1,916,795
1873 ..	76,610	439,501	446,550	2,409,861
1874 ..	76,723	465,517	713,251	3,944,233
1875 ..	79,950	499,028	567,560	3,387,219
1876 ..	65,309	419,209	622,488	3,732,405
1877 ..	58,200	378,435	606,762	3,654,488
1878 ..	80,073	499,889	555,272	3,179,326
1879 ..	63,032	391,166	438,725	2,264,591
1880 ..	53,259	302,993	531,649	2,826,586
1881 ..	50,118	285,606	496,724	2,720,831
1882 ..	54,854	301,675	575,560	3,241,622
1883 ..	50,638	262,193	503,299	2,831,813
1884 ..	60,181	277,466	510,009	2,896,613

Years.	HOLLAND.			
	BUTTER.		CHEESE.	
	Cwts.	£.	Cwts.	£.
1870 ..	406,795	2,388,459	422,553	1,204,830
1871 ..	390,616	1,986,708	348,148	954,236
1872 ..	269,091	1,358,579	329,535	942,537
1873 ..	279,004	1,453,875	336,654	1,013,233
1874 ..	351,605	1,877,755	398,888	1,164,921
1875 ..	357,106	1,917,910	370,123	1,078,594
1876 ..	402,984	2,252,909	330,435	949,413
1877 ..	372,134	2,084,686	341,980	984,855
1878 ..	460,601	2,494,903	355,159	1,018,669
1879 ..	655,377	3,331,149	275,039	743,107
1880 ..	810,509	4,076,399	288,666	810,590
1881 ..	745,536	3,745,885	264,626	747,052
1882 ..	921,182	4,310,830	310,735	866,061
1883 ..	988,266	4,204,121	292,515	824,576
1884 ..	1,115,394	4,995,045	319,441	893,416

STATISTICS OF DAIRY PRODUCE.

The following remarks relating to butter and cheese are extracted from 'The Grocer':—

Irish Butter.—At scarcely any period of the past year could it be said that the demand for Cork butters was really brisk, as their hold upon the London market at the best of times has not been very great, and with imports of genuine butter and other mysterious compounds pouring in from the Continent without intermission, in defiance alike of both drought and moisture on the different lands, there has been nothing to prevent a marvellous cheapness in butter nearly all through the year. The highest rates were in January and February last, when, in the absence of firsts, seconds realised 118*s.* to 140*s.*, and thirds 89*s.* to 100*s.*; but in March the latter fell to 90*s.*, and fourths could be had at 51*s.* to 52*s.* per cwt. In April the Cork market was closed, and on its re-opening for the new season at the beginning of May the quotations were for firsts, 101*s.* to 105*s.*; seconds, 85*s.*; thirds, 67*s.*; and fourths, 49*s.* Low as these prices undoubtedly were, those early in June were still lower, when firsts were quoted at 90*s.*; seconds, 72*s.* to 73*s.*; thirds, 65*s.* to 66*s.*; and fourths, 43*s.* to 44*s.* After that (in July) there was a sharp rebound to 92*s.*, 87*s.*, 79*s.*, and 66*s.* respectively; and in the months of September and October the current terms were 106*s.* to 107*s.* for firsts, 87*s.* to 90*s.* for seconds, 72*s.* to 80*s.* for thirds, and 60*s.* to 65*s.* for fourths; but since then there has been a fresh decline for the inferior sorts, the closing rates for which are 58*s.* down to 41*s.*, but the finest Corks were dearer.

Cork Butter Market.—For all but the superfine brand (which is only affixed to a very fractional part of the annual receipts) the prices paid in Cork ruled lower than those of any other recognised butter market in the world. For many periods of the season the price of the second brand of Cork butter was quoted much lower than the prices of good brands of butterine, Cork thirds did not fetch the price of second-grade butterine, and Cork fourths were for a long time quoted at the usual price for grease—say, 3*d.* or 4*d.* per lb.

Foreign Butter.—Prices for all denominations classed under this head have also been beaten down considerably during 1885, and bear additional testimony to the universal depression that has prevailed. The year opened with Normandy butter at 100*s.* to

144*s*., and Dutch at 124*s*. to 128*s*., and no material change took place till March, when the top quotations of these principal kinds were 130*s*. and 124*s*. Subsequently, only 108*s*. and 90*s*. were paid; and in June, when all descriptions were at their cheapest, the range for Normandy butter was from 70*s*. to 104*s*., and for Dutch from 56*s*. to 66*s*. In July and August an appreciable rise was recorded, when prices for the best qualities were 104*s*. to 110*s*., followed by a still greater advance in the later months, when, in October, Normandys fetched 80*s*. to 130*s*., and Dutch 112*s*. to 130*s*. Since then the market has been rather unsettled, but the more recent quotations have been on a parity with those just named. The value of American butter has varied in proportion, starting at 80*s*. to 124*s*., dropping to 50*s*. to 110*s*. in March, 40*s*. to 90*s*. in April, and stopping at 40*s*. to 50*s*. about the middle of the year; but latterly prices have been advancing, and have ruled from 60*s*. to 110*s*. per cwt. The movements in other descriptions have been of minor importance.

Cheese.—The trade in cheese has maintained the extraordinary dimensions which it reached in 1884, and its rapid disappearance from the market into consumption has been chiefly due to the persistent manner in which importers and others have forced its sale almost regardless of price. All kinds have undergone a severe depreciation in value, and present quotations, though shillings above the late lowest point, are still so reduced that some holders are now looking forward to a permanent reaction. American cheese, as usual, has taken the lead in our local market, and has been sold at varying prices throughout the year. At the commencement 45*s*. to 68*s*. were the asking rates for ordinary to prime qualities, but a flat tone shortly ensued, particularly for the lower grades, which were disposed of at 36*s*. to 40*s*. per cwt. In May the heaviness increased, and the worst kinds lost value so perceptibly that 30*s*. to 35*s*. was the most that could be got for them. The prime makes in their turn likewise suffered, and from June till September the best prices obtainable for these were 40*s*. to 46*s*., or quite 20*s*. per cwt. below the opening prices. Lately there has been a rather better demand at firmer rates, and the finest American cheese now sells at 50*s*. to 54*s*., with useful sorts at 38*s*. to 42*s*. Dutch cheese has been offering on proportionate terms during the year, and at the close the best descriptions are 6*s*. to 10*s*. per cwt. cheaper than they were a twelvemonth ago. English makes of all sizes and shapes have participated in the depressed condition of the market which has characterised the year 1885, and the closing quotations rule about 10*s*. under those in January last.

The Quotations in the following Table are extracted from 'The Grocer.'

TABLE XIX.—PRICES of BUTTER and CHEESE in LONDON during the FIRST WEEK of JANUARY of each of the TEN YEARS, 1877–86.

BUTTER.

	1886.	1885.	1884.	1883.	1882.
BUTTER (per cwt.):—	s. s.	s. s.	s. s.	s. s.	s. s.
Cork 1sts	.. ..	.. ..	134 to 143	.. ..	136 to 140
2nds	117 to ..	119 to 136	130 ,, 136	.. ..	129 ,, 131
3rds	75 ,, ..	89 ,, 91	94 ,, ..	115 to ..	111 ,, 113
4ths	50 ,, ..	58 ,, ..	70 ,, ..	89 ,, ..	82 ,, ..
Normandy	80 ,, 144	100 ,, 142	97 ,, 144	110 ,, 150	110 ,, 150
Dutch	.. ..	.. ..	124 ,, 136	134 ,, 144	125 ,, 144
American	60 ,, 112	80 ,, 124	75 ,, 122	.. ..	60 ,, 122
Bosch, &c.	40 ,, 90	45 ,, 90	40 ,, 80	60 ,, 90	50 ,, 85
	1881.	**1880.**	**1879.**	**1878.**	**1877.**
Cork 1sts	141 to 143	145 to ..	126 to 133	134 to 137	150 to 162
2nds	138 ,, 141	143 ,, ..	116 ,, 121	125 ,, 127	140 ,, 154
3rds	104 ,, 107	110 ,, ..	78 ,, 80	99 ,, 101	119 ,, 120
4ths	77 ,, 78	97 ,, ..	.. ..	72 ,, ..	90 ,, 91
Normandy	108 ,, 150	110 ,, 130	75 ,, 136	85 ,, 148	100 ,, 158
Dutch	120 ,, 130	124 ,, 130	116 ,, 120	124 ,, 130	142 ,, 146
American	95 ,, 130	90 ,, 130	50 ,, 110	60 ,, 120	95 ,, 130
Bosch, &c.	65 ,, 84	65 ,, 90	56 ,, 70	56 ,, 74	80 ,, 110

CHEESE.

	1886.	1885.	1884.	1883.	1882.
CHEESE (per cwt.):—	s. s.	s. s.	s. s.	s. s.	s. s.
English	50 to 78	64 to 85	64 to 86	62 to 82	60 to 82
American	34 ,, 54	45 ,, 68	40 ,, 68	46 ,, 70	42 ,, 68
Gouda	50 ,, 54	40 ,, 52	54 ,, 64	54 ,, 62	56 ,, 62
Edam	46 ,, 52	54 ,, 62	61 ,, 66	56 ,, 64	57 ,, 64
	1881.	**1880.**	**1879.**	**1878.**	**1877.**
English	70 to 90	66 to 86	40 to 84	60 to 90	46 to 94
American	56 ,, 72	56 ,, 70	24 ,, 53	54 ,, 70	46 ,, 74
Gouda	60 ,, 68	56 ,, 62	48 ,, 56	56 ,, 64	50 ,, 62
Edam	62 ,, 68	60 ,, 64	46 ,, 56	60 ,, 66	60 ,, 68

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

I.—*Foot-and-Mouth Disease: its History and Teachings.* By JAMES HOWARD, Clapham Park, Bedfordshire.

(1.) INTRODUCTION OF THE DISEASE, AND SUBSEQUENT OUTBREAKS.

IN the very first volume of the 'Journal of the Royal Agricultural Society' (1840), there appeared a Report on the "Recent Epidemic among Cattle," a complaint subsequently termed Foot-and-Mouth Disease. In the following year, 1841, the 'Journal' contained a further Report from the Veterinary Committee of the Society, which it appears had been instructed to institute an enquiry among the members of the Society as to the origin of the epidemic, its symptoms, and the remedies to be applied.

The information collected by the Committee established the fact that the disease was a new one, and had not been known in Britain before the summer of 1839. Viewed in the light of our present knowledge, many of the opinions broached as to the origin of the disease are most amusing, and some of them very absurd; moreover, none of the opinions expressed give evidence of any sound knowledge of the habit and course of the contagion; and this remark equally applies to those who were looked up to as authorities for guidance.

As the first volume of the 'Journal' contains an account of the introduction of a disease which has entailed such wholesale loss and trouble, it appeared to the writer, now that the country has been freed from contamination, that it would be appropriate to place upon permanent record in the 'Journal' an account of the experience gained of the formidable malady.

The old veterinary books afford evidence that the complaint was unknown in England before 1839; for, in describing the

various diseases to which the animals of the farm are liable, the writers made no mention of foot-and-mouth, or any disease akin to it. Thus, in Pearson's 'Horse, Cattle, and Sheep Doctor,' published in 1811, sixty diseases of cattle and sheep are described, but there is not a word upon foot-and-mouth. In the earlier editions of Clater's 'Cattle Doctor,' no mention whatever is made of the disease; but in 1853, when the tenth edition was published, the following remarks occur: "Since the eighth edition of this work was published, a new disease (foot-and-mouth) has appeared among cattle and sheep, and for the last twelve years has spread through the kingdom, scarcely sparing a single parish."

When "the distemper" was first publicly reported to exist in dairies situated in the environs of London, viz., in July 1839, the English veterinarians of the day appeared to be totally unaware of the nature and history of the malady, and wrote of it as a novelty and a wonder; some of them suggested that it might be due to peculiar atmospheric influences. This want of knowledge was remarkable, for in December of the previous year, 1838, a paragraph had appeared in the London newspapers, announcing that an "epidemic disease prevailed at this time amongst cows in the neighbourhood of Houdan and Pontchatron, in France, large swellings appearing on the feet, to such an extent as to prevent them from walking: the animals lose their appetites, and foam greatly at the mouth." Again, in November 1839, 'The Farmers' Magazine' contained a letter from a German correspondent in Mecklenburg, expressing surprise that English veterinarians should be ignorant of a disease which had been known on the Continent for several years. He stated that it came from Poland, through Pomerania and the Marshes of Russia, reaching Mecklenburg in the spring of 1838. Professor Fergusson also appeared to have had some experience of the malady, for, in a lecture to the Royal Dublin Society in 1841, he stated: "In the year 1836, while I was attached to one of the Continental veterinary colleges, the disease attracted my attention from its great prevalence and destructive effects among the herds of the neighbouring hamlets. Although new in this country, the present epizoötic had travelled through Spain, Portugal, France, Switzerland, Holland, Belgium, Bohemia, Hungary, and Prussia, previous to making its appearance in England, which it seems it did, on the western coast, about two years ago."

Further, a paper by Dr. Gilmeister, veterinary surgeon of Bavaria, read by Mr. Erne before the Veterinary Medical Society in May 1840, showed that foot-and-mouth disease prevailed in Hungary and Lower Austria in 1834; that it spread

rapidly to Bohemia, Saxony, and Prussia, afterwards to Mecklenburg, and also through Germany, Holland, and France.

The inference is plain that foot-and-mouth disease overflowed into England from the reservoir of contagion in Europe, just as on a late occasion it was, without doubt, carried from England into Ireland. Whether it appeared first on our west coast, as Professor Fergusson stated, or in the suburbs of London, as was first reported, the malady certainly came at a time when the importation of live animals was prohibited by law, the prohibitive statute not having been repealed until July 1842.

With our present knowledge we can readily understand how the contagion might have arrived by mediate conveyance; for, disregarding the teaching of Dr. Layard, who, as far back as 1747, urged, respecting another foreign murrain, that of all cautions, prohibiting the importation of infected cattle and hides is of the greatest importance; so foolish and ignorant were we at this period, that, whilst foot-and-mouth disease was raging on the other side of the German Ocean, we were all the time importing "untanned foreign hides," not disinfected in any way. In 1838, the imports of such hides amounted to 346,348 cwts.

It is quite possible that the contagion reached our shores by a diseased animal, for although prohibition was the law, it was very common for milch cows, brought for the ship's use, to be seen at our ports, where there was often no obstacle to prevent the sale of such an animal. Or, it may be true, as has been stated, that Professor Youatt traced the first outbreak of the malady to certain diseased specimens of the bovine species imported for the Zoological Gardens in 1839, immediately after which the complaint was discovered at Stratford, in the suburbs of the Metropolis, from whence some diseased animals were sent into Smithfield Market. In the next month, September, the disease was discovered, not only in the Smithfield Market, but among cattle near Loddon, in Norfolk. From various centres the infection was carried into Scotland and Ireland; so virulent was the disease, that it is recorded, "baskets-full of hoofs of swine and sheep were often swept up after the Smithfield Market was over."

That the formidable disease was, with so much complacency, permitted to exist in our midst for the long period of forty years seems, with our present knowledge, simply astounding. There is no reason for believing that these Islands were ever completely clear of the contagion, from the date of its first introduction, until the year 1880.

The first invasion of the contagion, in 1839, reached the height of its ravage in 1840 and 1841, followed by two years of

decline; the second outbreak occurred in 1845; the third in the latter part of 1849, lasting over the year 1852. A considerable period then elapsed before another accession took place, viz., in 1861; and after 1863 came a period of quiescence lasting for a year and a half. In the middle of 1865 began the fifth spread of the disease, and this occurred simultaneously with the invasion of rinderpest.

The strict measures applied against cattle-plague (rinderpest), in 1866, had the effect not only of checking the course of foot-and-mouth disease, but also of opening the eyes of farmers to the fact that the troublesome complaint was amenable to vigorous measures for its suppression; for, although it was not entirely extirpated at that period, very few centres remained in 1868. The sixth outbreak, which set in during 1869, proved to be an exceedingly severe visitation; between August of that year and the close of 1871, there were officially reported in Great Britain, 92,162 outbreaks, and 1,344,525 animals attacked.

Official returns were discontinued in 1872, but the disease only began to decline in intensity toward the latter end of that year, and the Veterinary Department reported that "considering the comparatively slight attention which was given to the subject of sanitary regulations in regard to foot-and-mouth disease at that time, it is probable that the actual outbreaks were double the number of those that were reported." Three or four million cattle, sheep, and pigs, smitten with the disease in the three years, may easily have destroyed, directly and consequentially, eight to ten million pounds sterling of agricultural capital.

After a lull in the prevalence of the contagion, it rapidly increased in 1874, beginning, however, to decline again in the autumn of 1875. The eighth outbreak occurred in December 1876, and had spread over considerable parts of England, Wales, and Scotland, before the cattle-plague (rinderpest) restrictions, imposed in 1877, checked the course of the mischief; so effectual did they prove that, by the end of 1878, only two centres were known to the Veterinary Department in Great Britain. The ninth outbreak, early in 1879, was met by restrictive measures, and happily was stopped before the contagion had obtained any grasp of the country, and during the first nine months of 1880 the kingdom was absolutely free from the disease.

Although it cannot actually be demonstrated that germs of the contagion survived in some protective concealment throughout the spring and summer of 1880, and these with sufficient vitality to start the disease again in the autumn, the hypothesis that such germs were so preserved, and that they did start again

into activity, not before, but just after infected animals had imported a new stock of the contagion from France, is so monstrous a fitting of theory to fact to serve a purpose, that it cannot for a moment be entertained.

The first case of foot-and-mouth disease in 1880, outside a foreign cattle market, was detected on the 1st of October in a dairy in the City of London; and immediately afterwards, reports of the existence of the disease were received by the Veterinary Department from Bedfordshire and Kent. Surrey, Essex, Norfolk, Lincolnshire, Buckinghamshire, Leicestershire, and Nottinghamshire were quickly invaded, and, by the end of the year, the contagion was extensively spread. Hence it clearly appears that whilst foot-and-mouth disease broke out in London at the end of September, no re-importation of the contagion could have escaped inland from any of the infected cargoes which had been landed at English ports and safely slaughtered, between January 1 and the middle of September 1880, at which period an arrival at Deptford of infected French animals was speedily followed by the outbreak in a London dairy.

The chain of evidence is complete, and the fact demonstrated that the regulations in force at Deptford Market, which failed to prevent rinderpest from travelling inland from its landing-place, in 1877, also failed in 1880 to intercept the subtle foot-and-mouth contagion. Thus, in the middle of September 1880, the Inspector of the Privy Council, at Deptford, had his attention called to signs of foot-and-mouth disease in the tongues of some French cattle which had been slaughtered in the market. A portion of the lot had been disposed of before the authorities became aware that the infected animals had been in the lairs of the market, in which place they might have been freely handled by persons attending both Deptford and the Metropolitan Home Cattle Markets on the same day. Here was one obvious channel by which the contagion might have escaped into London.

On September 20, a cargo of cattle from Havre was landed at Deptford, and by "the second day after landing," *i.e.* before adequate precautions had been put in force to intercept possible contagion among the animals, they were inspected, when some of them were found to be affected with foot-and-mouth disease; by that time the contagion could have, indeed had, been carried past the precincts of the market. The official report of the Veterinary Department afforded specific information on this point; it stated that "Consignees and others who have business at Deptford conduct their affairs on a large scale, and the dealer who handles diseased animals in the morning at Deptford may, in a few hours, be touching animals standing in a market

many miles distant, and thus unwittingly become a means of disseminating the infection." It happened in the case of the outbreak of foot-and-mouth disease in the City, that a possible channel for the conveyance of the infective matter was recognized. A few days before the disease appeared, a butcher, who had premises at Deptford, visited the City dairy and endeavoured to arrange for the purchase of a fat cow. Further, it appears that the state of the diseased animals in that dairy proved that the infective matter must have been introduced some time previously to the discovery of the disease. Great quantities of the virus were generated in Deptford Market, for, at the time of the importation of the diseased cattle, the lairs happened to be so overcrowded that no opportunity was afforded for effectual disinfection of the places contaminated by the disease.

An outbreak of foot-and-mouth disease was once known to occur on the premises of a butcher in the town of Deptford, which was traced to the circumstance of his pigs having eaten the intestines of diseased sheep, which had been killed in the Deptford Foreign Cattle Market. Then there is a vehicle of transmission of contagion by means of hides, nominally disinfected, but not always absolutely safe. In 1881, Mr. James P. Heath, Veterinary Inspector for the County of Devon, adduced facts proving the conveyance of the disease by hides. Another medium for the introduction of the disease consists in the removal of timber fittings and pens from cattle-carrying vessels, which are often sold to carpenters and others in this country; then, again, the manure out of such vessels is a still more likely medium for the spread of contagion.

Foot-and-mouth disease was carried over the border into Scotland in March 1882, after that division of the kingdom had enjoyed total immunity since 1878. A second introduction occurred early in 1883, brought by cattle directly from Ireland, where the disease had gained a footing.

The evidence gathered at the time showed conclusively that Ireland, which had for a very long period been perfectly clear of the disease, was infected by a bull imported by Lord Carbery from Westmoreland, and shipped at Liverpool. It would be a most singular coincidence that the contagion entered Ireland simultaneously with the bull, but was conveyed in the dress of drovers, who had been attending markets in affected districts of Lancashire; this, however, was the official theory, but it must be remembered that the same drovers had been constantly going backward and forward. It may be admitted that the bull had not contracted disease in his native country, as he was purchased of the Rev. F. Staniforth, of Storr's Hall, Westmoreland, and no foot-and-mouth disease had been known in the neighbourhood for years; nor at

the time the animal was sent away did the disease exist in the county. The bull was shipped from Liverpool, and doubtless became infected during transit either on the rail or on board ship. The course of this entrance of the disease into Ireland, as gathered from the facts published at the time, was that the bull arriving in Dublin on January 17, 1883, showed symptoms of the complaint on the 22nd; the infection was carried to yards where pigs were feeding, probably by the mediate agency of veterinarians; some of these pigs were exposed in Dublin market, and were afterwards found diseased on the quay, awaiting shipment for England; and a number of store cattle, from the store market alongside the pig market, were driven to the shipping yard, where the imported bull had been landed, and where the diseased pigs had been found; these cattle were thence embarked for Glasgow, where they landed on February 4, and were found diseased two days later at Edinburgh.

I need not recapitulate the subsequent course of the disease in England and Scotland, with the repeated suppressions in Scotland, followed by repeated re-introduction, clearly traced to animals from Ireland, while the latter country continued affected.

The whole history from first to last, and especially the contamination of Ireland, which had remained free for a long period, in spite of conditions, always present, which might generate the disease, if such an origin were possible, is consistent with the germ theory—a subject enlarged upon later on. The only rational principle of combating the contagion is based on a recognition of the germ theory, and consequently, to be carried out by the most effective measures for not only preventing arrivals of the contagion on our shores, but for promptly stamping out initial cases when it has eluded the safeguards and obtained a footing within the kingdom.

(2.) Legislation upon Foot-and-Mouth Disease.

Looking back over the period from our first becoming acquainted with the "distemper" to the passing of the recent legislative measures, one is amazed at the ignorance which so long prevailed with respect to the formidable character of the disease. For a long course of years, how many agriculturists were under the impression that the malady was a dispensation of Divine Providence, against which it was vain to contend; whilst a greater number believed that the complaint originated spontaneously, or came "in the air"; and these notions still linger in some quarters! A few eminent men, Sir Lyon Playfair, M.P., among the number, still uphold the existence of some occult law of "periodicity," which governs the re-appearance and subsi-

dence of contagious diseases; but this theory may be at once dismissed, inasmuch as it is founded simply upon hypothesis, and does not rest upon any ascertained facts.

Astounding as it may seem, it is a fact that no attempt at legislation upon foot-and-mouth disease was made until five-and-twenty years after its introduction. In 1864, Mr. Bruce (the present Lord Aberdare) and the late Sir George Grey brought in a Bill "to make further provisions for the prevention of contagious disease among cattle." This well-conceived measure, which, had it been passed, would probably have saved the country from the loss of scores of millions, met with the strongest opposition from cattle-dealers, salesmen, butchers, and those engaged in the Irish cattle-trade, who, forsooth, stood forward, as they have often done since, as the champions of cheap meat. Singularly enough, this opposition was backed by leading agriculturists, and was strongly supported by many influential county members of Parliament; indeed the opposition was so strong that the measure had to be abandoned.

The experience gained by the operation of the measures put in force against rinderpest in 1866 and 1867, led to the conviction that the milder, but more mischievous foot-and-mouth disease might be exterminated by similar stringent means; an agitation forthwith set in for legislation, the first result of which was the Contagious Diseases (Animals) Act of 1869, brought in by Mr. Forster. The Act provided against the movement and exposure of animals affected with the malady; duties and obligations were also placed upon Local Authorities in relation thereto. Orders in Council for the isolation of animals, in the case of certain outbreaks of foot-and-mouth disease, were also provided for. The results, however, of such action proved so unsatisfactory that the Select Committee of the House of Commons, which took evidence in 1873, agreed to a recommendation that the Privy Council should cease to issue orders for the check of the disease. Yet it was plainly felt every time the kingdom came under the mastery of the contagion, that it would never do to submit helplessly in this matter; the outcry was for something to be done at head-quarters, while head-quarters considered that farmers were not prepared to submit to measures elaborate and stringent enough to be effectual.

Under the Animals Order of 1875, Local Authorities had power to prohibit or regulate the removal of infected animals, or such as were in contact; and when an animal fell with the complaint during exposure in a public place, or while being moved, a Local Authority might arrange for its slaughter, or for its feeding and watering, or its being dealt with for ordinary

breeding purposes. One rule which was not permissive, was that persons in charge of infected animals must give notice to the police, so that the Inspector could in due course inform the Local Authorities of the outbreak. Naturally, the failure of such haphazard, unconcerted proceedings by Local Authorities inflicted much trouble and vexation upon trade and traffic; it involved interference at large with fairs and markets, and the business operations of farmers and graziers, while proper isolation and disinfection in the case of individual outbreaks were omitted; and, altogether, the effect was to weaken the faith of farmers in any measures prescribed by the wisdom of legislators.

Better things were hoped of the Contagious Diseases (Animals) Act of 1878, which measure, brought in by the Duke of Richmond, left to each Local Authority the duty of taking all the steps it thought necessary against foot-and-mouth disease in its own district. The Local Authorities were bound to appoint Inspectors and other officers to investigate outbreaks, and, on receipt of a verified report, to declare the limits of an "infected place." A Local Authority was also expected to send up to the Privy Council its opinion whether or not an "infected area" should be declared, and whether it was expedient or not to interfere with any particular market, fair, sale, or exhibition. But, generally speaking, these specified advices to the Privy Council were not, when foot-and-mouth disease was at its height during the last great outbreak, forthcoming; nor did the powers accorded by the Act to the Privy Council, to supplement defective action on the part of Local Authorities, operate effectually against the mischief. Thus the insufficiency of the Act of 1878—a measure at first favourably regarded, owing to a comparative degree of success obtained in combating the outbreak of 1879—was, by the lamentable experience of the years succeeding the last outbreak, completely demonstrated.

It is not, as has been often asserted, wholly to the prejudice and obstinacy of breeders and grazers, or the impatience and selfishness of dealers, that we can attribute the averseness to heroic measures for exterminating foot-and-mouth disease. The public were shrewd enough to perceive that the results obtained were not sufficiently promising; that the wholesale measures enforced over wide tracts of country were not adequate to the required end. The parties interested had been slowly learning, by the course of events, that the machinery of the Act for dealing with internal outbreaks of foot-and-mouth disease, was at fault; that so long as uniform control was not provided for, and a system of compulsory regulations enforced, which could be immediately applied at the moment of emergency, the machinery was imperfect. As a matter of fact, the sacrifice to

business from years of prolonged but ineffective restrictions was incalculable; the effect had been only to delay the progress, not really to stay the march of the contagion. That a better system of repression is requisite for the sanitary protection of our herds and flocks, than was enforced during the last outbreak, is palpable. The havoc caused, in its indirect and secondary consequences, may be multiplied from the opposite totals (page 11).

This record of an unbroken series of 27,933 outbreaks of foot-and-mouth disease, during which 335,766 cattle, 359,812 sheep, and 36,972 pigs were attacked before the malady was mastered, or rather before it subsided; and which, for the larger period of the four years' period, involved untold damage to business transactions from the difficulties of exporting pedigree animals, and from the absence of free buying and selling in most parts of the kingdom, completely destroyed the credit of such sanitary rules as prevailed, and produced the indelible impression that stock-owners would be better without the troublesome *régime* derived from the powers of the Act of 1878. For if so protracted and disastrous a visitation had followed from one single importation of the contagion (viz., into Deptford at the end of September 1880), and its escape inland, then, in future, no matter how carefully appointed might be our safeguard against another arrival of the disease from abroad, it would be hopeless to expect the disease to be confined within harmless limits with the existing apparatus of Orders administered by diverse Local Authorities, and, moreover, at the expense of the districts concerned.

The measures of prevention which had so grievously failed, consisted at first in declaring infected areas in various counties, so that during the first three months of the outbreak, viz., October to December 1880, the sale of animals, except for slaughter, had been stopped in thirty-seven English counties. On January 17, 1881, came into force the Markets and Trades Temporary Order—extended to Wales on February 11—and remaining in force till March 31: during the time of this Order, regulations were also enforced upon the movement of animals which had been exposed in Islington Market, and Local Authorities were empowered to shut out of their district animals from any district in England, Wales, or Scotland.

Throughout 1881, the Privy Council also continued to declare "infected areas," and to stop the sale of store stock, first in one locality, and then in another; but the figures, as to the number of outbreaks occurring each month, did not show that much headway followed these exertions. Early in 1882, something else was tried. The Markets and Trades Order was applied to

FOOT-AND-MOUTH DISEASE, from OCTOBER, 1880, to SEPTEMBER, 1884.

	Number of Fresh Outbreaks in each Month.	Number of Animals Attacked.		
		Cattle.	Sheep.	Pigs.
1880. October	49	505	744	193
November	225	3,133	606	218
December	1,175	17,264	8,222	1,475
1881. January	1,089	15,181	38,426	2,160
February	491	5,651	29,460	1,122
March	212	2,349	9,340	476
April	225	2,095	7,255	533
May	513	4,865	4,655	440
June	315	4,965	7,390	295
July	499	6,618	3,741	171
August	479	6,559	3,382	131
September	235	2,465	1,345	101
October	508	5,424	6,290	551
November	118	1,463	4,625	157
December	149	1,829	1,253	193
1882. January	133	2,011	1,749	142
February	74	779	911	238
March	80	885	720	72
April	188	2,456	154	223
May	93	815	2,793	114
June	34	341	833	16
July	55	440	109	10
August	287	2,608	771	86
September	154	2,179	436	160
October	90	840	140	58
November	325	3,887	811	368
December	457	6,732	1,985	1,047
1883. January	363	3,852	2,448	634
February	1,099	11,844	10,731	1,647
March	812	12,918	23,002	1,771
April	439	5,763	11,744	682
May	428	5,155	6,568	529
June	318	3,931	10,681	341
July	285	3,362	6,372	394
August	1,362	12,067	19,647	842
September	6,139	66,344	56,874	6,998
October	2,657	31,973	21,174	4,502
November	2,556	31,061	17,513	3,614
December	2,274	31,013	30,738	2,378
1884. January	437	6,860	9,052	1,008
February	237	2,099	3,324	530
March	125	1,523	874	196
April	83	1,038	20	75
May	29	374	561	29
June	7	22	343	7
July	12	152	..	..
August	8	41	..	2
September	6	29	..	..
October	..	1	..	..
November	5	44	..	10
December	..	3	..	3
Total	27,933	335,766	359,812	36,972

certain districts under the title of the Fairs in Districts Order, and, from time to time, fresh districts were added as foot-and-mouth disease spread. It is admitted that the "effect of the Order was to reduce the number of outbreaks in the districts to which the Order applied, while the number increased in other districts outside them." The Order ceased to operate in the spring; at midsummer came a lull, when a well-concerted effort might have had a chance of quickly stamping out the disease; but no such wise counsels prevailed, and, in December, recourse was again had to the Fairs in Districts Order for dealing with certain portions of the country.

The disease nevertheless spread more extensively, and made more victories in the next year, an increase of it in the early part of 1883 being attributed to contagion brought back to us from Ireland; and the unexpected spurt of the contagion late in the summer attained the monthly maximum of 6,139 outbreaks in the five weeks of September. If the re-imposition of restrictions on the movement of animals and the holding of cattle-markets all over the country, toward the close of 1883, accomplished any results, it was in a clumsy and unendurable manner; probably the subsidence of the disease from natural causes may be considered the truest explanation of the rapid diminution of cases in the winter and spring of 1884.

(3.) The Germ Theory.

Because a few isolated outbreaks of foot-and-mouth disease have occurred, without apparent source, months after the whole kingdom had been declared free from the contagion, and beoause the outbreaks at Necton Hall, Norfolk, at Crowland Common, Lincolnshire, at Ampthill Park, Bedfordshire, and others which might be mentioned, are not clearly traceable to re-importation, people recur to the old fallacy that, after all, the disease is of spontaneous origin, or is "in the air," or, as a well-known veterinary authority once put it, is "an atmospheric wave of disease of an abnormal character."

Many years ago, I read the published experiments of the late Dr. Budd, of Bristol, upon scarlet fever and other infectious diseases, which convinced me of the soundness of the germ theory: subsequent experience and study of the etiology of the subject—especially the researches of M. Pasteur—have confirmed me in the belief that the principle applies to all contagious diseases, and that outbreaks of foot-and-mouth disease which point to spontaneous generation would, if the cases could be thoroughly traced home, show that they were due to the presence of germs which had not lost their vitality.

A very instructive paper on "The Germ Theory of Disease" * was read before the Irish Central Veterinary Medical Society in 1883, by Mr. James Lambert, F.R.C.V.S., Inspecting Veterinary Surgeon for Ireland, Army Veterinary Department. Mr. Lambert expressed his belief "that every communicable, or transmissible, or contagious, or infectious, or specific disease depends on living organisms for its production and development." In his "Outlines of the Science and Practice of Medicine," Dr. Aitken gives the following definition:—"The germ theory holds that each specific disease has a specific poison-germ, which lives, grows, and has a being specifically distinct from each and all other germs."

It appears that under the English term "germs," and the continental term "microbes," the active agents in ferments and in disease production and conyeyance, known as "bacteria," include various forms, as the bacillus, micrococcus, diplococcus, vibrio, spirillum, and others; and that while bacteria themselves are easily killed by heat, even at so low a temperature as 140° Fahr., their spores or seeds are very tenacious of life. Indeed, some may be boiled for two or three hours, dried, and preserved in a dry condition for months, yet will revive under suitable conditions. Further, it is established that forage, straw, hay, clothing, birds, insects, and other objects can convey the eruptive fever. That the germs of foot-and-mouth disease, micrococci, may be conveyed from a diseased animal to another at a long distance has been demonstrated; but it seems to remain a debatable point whether the infection can be carried in the air, even for a short distance. The conclusion some scientific men have arrived at is that the duration of infective power in the *virus* does not, as a rule, last for many days; but occasional instances have been brought to notice in which the contagion has revived (whether preserved in a quiescent state in the spore condition or not) so as to present all the characteristics of an entirely new outbreak, and this a very long period after the disease has existed actively. Thus, in "Sanitary Science and Police," by Professor George Fleming, it is stated "that troughs which had been lying for four months exposed in the fields, but which had before been used by diseased animals, gave foot-and-mouth disease." In the same work, another instance is related:—"A farmer owned two farms in an out-of-the-way place, and some distance from each other. On one farm foot-and-mouth disease had prevailed severely; the other farm was free from it. The disease disappeared from the infected farm, and nothing more was seen of it for five months,

* Published by Bailliere, Tindall, and Cox, King William Street, Strand, London.

when one of the hay-racks was brought to the healthy farm, and very soon the cattle which fed out of this rack fell with the complaint." Here was a distinct preservation of the seeds of the disease during five months, for in the meantime "there was no traffic in the locality, nor yet disease, until the tainted rack was carried down."

An outbreak occurred at Ampthill Park, Bedfordshire, on July 9th, 1885, the origin of which was wrapped in mystery, until it was discovered that the animals had had access to some hay and straw which had been brought from Berlin with the furniture of the late Baron Ampthill (Lord Odo Russell). Although the packages had been despatched from Berlin in the previous October (they remained unpacked until the spring), and the cattle did not have access to the hay and straw until the following summer, it was difficult to account for the outbreak except upon the hypothesis that the germs of foot-and-mouth disease had been brought from Germany with the furniture. The only other solution of the mystery is, that an outbreak of foot-and-mouth disease had occurred in the same portion of the park in September 1883, and that on June 22nd, 1885, a divisional fence had been taken down, along the line of which a mass of long, coarse grass had existed, and in which the germs of the disease might possibly have been preserved. Looking, however, to the fact that nearly two years had elapsed, this hypothesis has little to recommend it. From my place in the House of Commons, I put certain questions to the Government relative to the origin of the outbreak at Ampthill. The answer I received having attracted the attention of a well-known Scotch farmer, settled in Ireland, he sent me the following particulars. A few years ago, during the hay season, when the grass was up in large "cocks," his sheep suffering from foot-and-mouth disease were turned into the field, and they were observed to be fond of lying around the "cocks." In due course the hay was stacked, and in the following summer some young cattle were fed upon it: to the great surprise of their owner, the animals were soon attacked with foot-and-mouth disease—he had brought no fresh animals on to the farm, and no disease had existed in the district for months, so that the only conclusion he could arrive at was that the seeds of the disease had been deposited at the foot of the "cocks," and carried to the hay-stack, in which their vitality had been preserved until served out to the cattle.

About twenty years ago, on one pasture-field of my own, three successive lots of fresh cattle brought on to the farm were mysteriously attacked with pleuro-pneumonia, and being at that time a believer in the germ theory, I had the hedges sheared, and the gates painted, and no cattle turned in for months, since which period no outbreak of that malady has occurred.

The re-appearance of disease long after the contagion has apparently died out from the spot may be of occasional occurrence only; certainly few cases of such recrudescence have been authenticated or recorded, probably because the great longevity of the germs had not been suspected or acknowledged,* and after the lapse of time since the last outbreak, we may, perhaps, safely conclude that if no further stock of *virus* be imported, no more will be heard of foot-and-mouth disease in the United Kingdom.

(4.) Measures of Prevention Required.

Experience has shown that the Acts in force do not provide an invulnerable defence against either the introduction or the spread of disease. On the arrival of diseased animals at Hartlepool and Deptford in January and February 1885, the contagion might, but for good fortune, have eluded the vigilance of the Inspector at the ports, and have escaped inland. The risk is so great, and the consequence so disastrous, that it is absolutely indispensable, whenever an outbreak occurs in the country, that we should be completely armed with measures of prevention to be put in force without a moment's delay. Indeed the probability that foot-and-mouth disease will be re-imported from time to time and escape inland from our ports, is so great, and the failure of our past treatment of the disease so disastrous, that no agriculturist will question the necessity for instituting a sound and reliable system of suppressing initial outbreaks. Knowing the danger of trusting to Local Authorities for prompt action in stamping out first outbreaks—especially Urban Authorities—it appears to be imperatively necessary that the Legislature should provide for uniform action throughout the United Kingdom, and should establish a machinery of internal regulations fully adequate to deal with isolated cases of disease. To avoid a repetition of former disasters, a watchful and ready apparatus must be organised, which shall be always wound up and spontaneously set in motion upon the appearance of danger in any locality. I have long maintained that an isolated centre of contagious disease should be treated like the occurrence of a fire, and rigorously watched until all danger of the disease spreading has passed away.

In no part of this kingdom have cattle diseases been more effectively and promptly dealt with than in the counties of Cumberland and Westmoreland. The plan pursued in these counties is very similar to that which has been long practised

* Professor Brown acknowledged at the Council Meeting of the Royal Agricultural Society in November last that little or nothing was known of the longevity of germs.—J. H.

with so much success in Denmark. The Cumberland system, so ably carried out by the Chief Constable, Mr. Dunne, briefly described, is as follows. Upon an outbreak of disease, the animals affected, and also those in immediate contact, are, by arrangement with the owners, slaughtered, and compensation, beyond the salvage, is paid to the owner. A cordon is formed around the infected place, and police officers stationed for the purpose of doing everything necessary to thoroughly isolate the infected fields or premises, and also to prevent animals being moved out of, into, or within the infected circle, except in the manner directed by the authorised regulations. All communication with the infected place is controlled so as to have all necessary precautions for avoiding the spread of disease carefully observed. And after the cessation of disease, the place, the manure, &c., &c., are disinfected, and the police remain on duty night and day for the space of twenty-eight days.

Reporting to the Quarter Sessions of Cumberland and Westmoreland, on October 17, 1883, Mr. Dunne pointed out that during the seven years previous to the putting in force of the system described, the losses caused by foot-and-mouth disease in the two counties amounted, according to official records, to upwards of 300,000*l.*; during the six years the system had been in force seven outbreaks of disease had occurred, and in each case the disease had been prevented from spreading beyond the farm or premises where it appeared; the loss to the farmers and the cost to the counties being infinitesimal as compared with the former period.

Here is a system of repression which has been well tried and proved to be successful both in our own and in a continental country. To make the United Kingdom safe against future extensions of the disease, I contend that these well-tried regulations for isolated outbreaks should be embodied in a compulsory Act of Parliament. The following provisions, in addition to existing regulations, would probably suffice:—

(*a.*) A Local Authority shall, upon any outbreak of foot-and-mouth disease, forthwith call upon the police authority to place the animals affected with the disease in quarantine, and to establish an efficient cordon round the infected place: such quarantine and cordon shall be carried out and maintained in accordance with regulations prescribed by the Privy Council.

(*b.*) A Local Authority, upon any such outbreak,* shall

* Since this paper was sent in, "The Foot-and-Mouth Disease Order of 1866" has been issued. Under the head, "Slaughter by Local Authority," is the following: "Any Local Authority *may*, if they think fit, cause any cattle . . . affected with foot-and-mouth disease to be slaughtered." *Cui bono?*—J. H.

cause any animals affected with foot-and-mouth disease, or any animals being or having been in the same shed, or herd, or flock, or pig-sty, or in contact with animals affected with foot-and-mouth disease, to be slaughtered within sixty hours after the existence of the disease has been made known to their Inspector or other officer.

In order to avoid the slaughter of exceptionally valuable herds or flocks, a proviso might be added, as follows:—

(*c.*) That if the owner of an animal or animals give notice in writing to the Inspector or other officer of the Local Authority that he objects to the animal or animals being slaughtered, it shall not be lawful for the Local Authority to slaughter such animal or animals except with the special authority of the Privy Council first obtained.

I am aware that many stock-owners entertain a strong objection to slaughter in cases of foot-and-mouth disease; but in discussing the point they are apt to lose sight of the fact that the remedy is for adoption in isolated cases only, and as a simple and effectual means to a most important end. Again, although the disease generally yields to proper treatment,* the risk of its spreading whilst cure is being attempted is stupendous; and every fresh centre multiplies indefinitely the difficulty of checking its ravages. Immediate slaughter is therefore not only the safest course, but, in the great majority of cases, the most economical—as has been abundantly shown by the experience gained in Cumberland and elsewhere.

Further, it should not be forgotten that whenever England is unable to show a clean bill of health in respect of foot-and-

---

* Hyposulphite of soda has, in my neighbourhood, been found efficacious both for curative and prophylactic purposes; 4 oz. dissolved in hot water being given to each bullock or cow twice a week, and the whole body, as well as the mouth, being washed with a weak solution of carbolic acid.

When in Austria and Hungary, I learned that the following treatment had been found very efficacious:—

"Take honey, 1 lb., muriatic acid, 1¼ oz.; mix them well with a wooden spoon in an earthenware vessel; apply, with a wooden spatula, about a small dessert-spoonful to the tongue three times a day, leaving the animal to distribute it over the inside of its mouth by the champing motion, which is sure to follow its application.

"For the feet: take aloes, ½ oz., rectified spirit, ½ pint, alum, ½ oz.; dissolve them in one pint of water; mix, and apply a little twice a day between the claws.

"In addition to the above treatment, rye, or other meal, ground very fine, should be placed in the manger—a little being dusted over the noses of the animals in order to induce them to eat; the meal being almost impalpable, they will lick a little without increasing the irritation."—J. H.

mouth disease, other countries prohibit importation, and, as a consequence, the interests of breeders of pedigree-stock are seriously endangered. The trouble, inconvenience, and loss also sustained by all connected with the home trade through the restrictions interposed can scarcely be estimated. Nor should the effect upon those opposed to the present restrictive policy, of our tolerating the presence of the disease in the heart of the country, be lost sight of; for surely no agriculturist can deny that centres of disease in the heart of our great grazing districts are infinitely more dangerous than the presence of the same disease at either of our ports of landing, each with its isolated "foreign animals wharf."

From the annual report of Professor Brown to the Privy Council Office, it is evident that no lesson taught by the events of the last outbreak can be clearer than that when the disease becomes rampant throughout the country, Local Authorities and the Privy Council are all alike powerless, for no ordinary restrictions prove sufficient to stop its progress; nothing, indeed, short of the regulations put in force for stamping out rinderpest will suffice to arrest the disease; hence the importance of the initial blow aimed at an isolated outbreak being certain and effective in its delivery.

It is contended that if isolated cases are treated in the manner above proposed, no widespread prevalence of the malady can possibly recur; for, as stated, each outbreak in a flock or herd would be treated like the occurrence of a fire, and vigilance would not be relaxed until the last ember had been completely extinguished.

II.—*Organs of the Animal Body: their Forms and Uses.*

By Professor Brown.

It is an open question how far a farmer may usefully pursue the study of the sciences which have reference to his daily work. To put the point plainly; does he gain much, or at all, by knowing how crops grow or animals are made up? Is he any the better because he has some idea of the "why and wherefore" of things which are always going on under his eyes? Only one answer can be given in these days of School Boards to such questions, which is, Yes—unless he means to be left far behind in the race for daily bread, not to speak of the duty of paying as much attention to the improvement of his mind as he does to the cultivation of his crops and live-stock.

To know much of the structures which go to form a man, a horse, or an ox, means a good deal of hard work with the knife and forceps; but the stock-owner who is constantly employed about his animals can hardly avoid feeling some curiosity in regard to the arrangement of the parts of which they are formed; and when he finds from time to time a sheep or lamb lying dead in the pasture, he watches while the shepherd cuts up the carcass in a rough way, and forms some idea, very likely a wrong one, of the nature of the injury which has caused the animal to die.

But, objects the expert, the farmer should send for some one who knows all about the organs and their disease, and trouble himself no more about the affair; in short, act as he does when his watch stops—apply to the watchmaker. Admit the force of this objection, and apply the same principle to all matters of farming, and we get an odd result. The farmer need not have a care. A skilful chemist will find out all about the soils of his fields, and select the proper manures. A botanist will decide as to the seeds to be sown, and will inquire about diseases which affect plants. Insect pests need not upset his peace of mind, the entomologist will manage them; and as the live-stock of the farm will be in charge of the physiologist when in health, and of the pathologist when they are ill, he will be free from all care about them. The farmer's business is to plough and sow, to reap and mow, to buy and sell, and content himself with his cake and ale, and his evening pipe, after the manner of his forefathers of a few centuries ago. The writer of these words is by no means sure that the farmer of the present day would not be happier than, and at least as well off as, he is now if he took the words seriously, and followed the advice strictly. But, at the same time, he is sure that, good or bad, such advice comes too late in the day to be accepted.

Taking for granted that the modern farmer must learn a good deal of which the farmer of old was, perhaps happily, ignorant, it is proposed in this paper to try to teach him a little of what scientists call anatomy and physiology—that is to say, in English, the several parts of animals and the uses of them. First, to avoid any doubt as to the scope and object of this essay, it is best to state at once to the reader that the whole subject has been written on over and over again. All that follows, and much more, is in print, in many large books which the farmer can read; if he likes, but most likely will not, and in this paper it is only intended to select facts and pictures already published, and make a very small book out of some very big ones. A list of the books which may

be read by those who desire to study the subject further will be given at the end of the paper; but special mention must be made of the very complete work entitled, 'The Comparative Anatomy of the Domesticated Animal,' by Mons. A. Chaveau, Professor at the Lyons Veterinary School. This book has been brought within the reach of the English reader by Dr. George Fleming, who did the arduous work of translating it in 1873. The woodcuts are, from an anatomist's point of view, very beautiful, and many of them are introduced into this paper by permission of the publishers, Messrs. J. and H. Churchill and Messrs. Ballière fils, of Paris.

Keeping in view Practice with Science, it is proposed, in describing the structures of animals, to assume that the farmer is looking on while a rough sort of cutting-up or dissection of a dead animal is being done, and it may be further assumed that the looker-on has got from seeing pictures of the bones in their proper places, or the actual bones in a museum, an idea of the skeleton, a knowledge of which he cannot gain by cutting up a carcass in the field.

To assist the inquirer in getting some notion of the bony frames of the animals of the farm, advantage has been taken of the excellent cuts in Chauveau's book just mentioned, and in the four following illustrations will be seen the skeletons of the horse, cow, sheep, and pig.

Fig. 1.—*Skeleton of the Horse.*

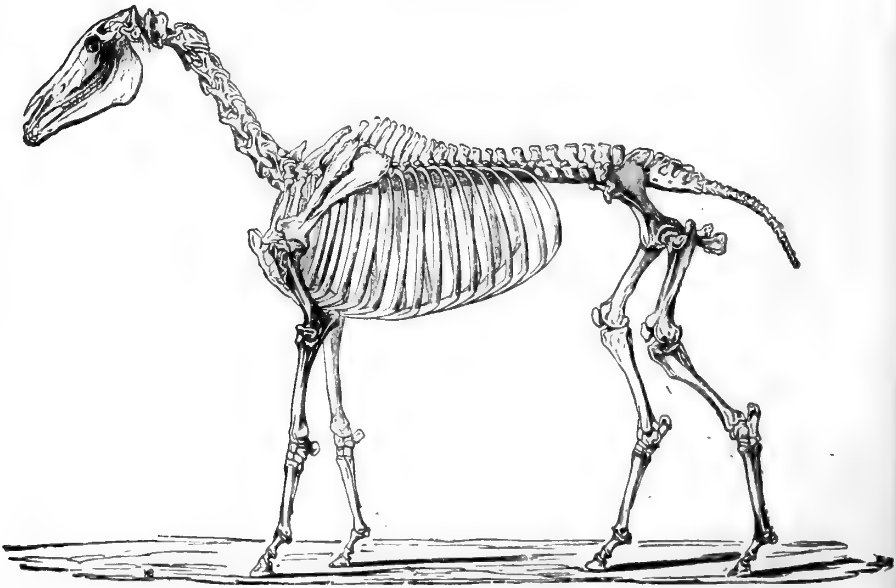


Fig. 2.—*Skeleton of the Cow.*

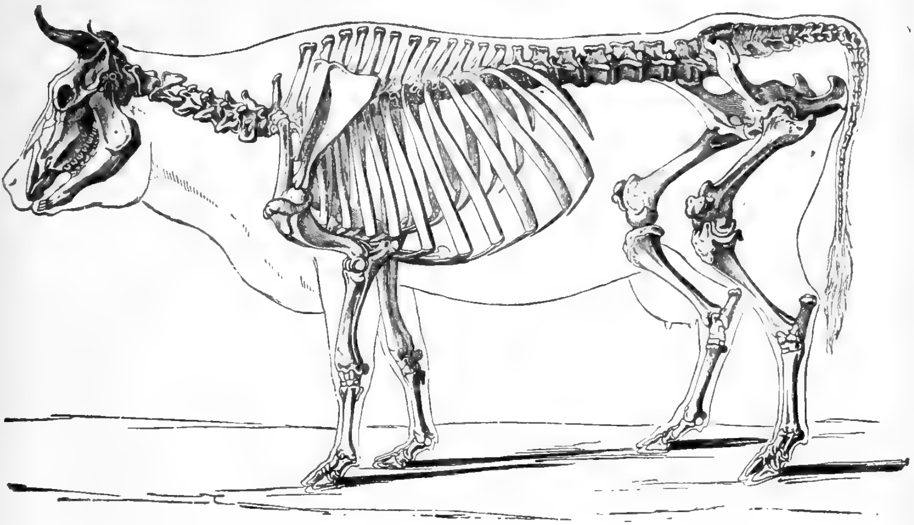


Fig. 3.—*Skeleton of the Sheep.*

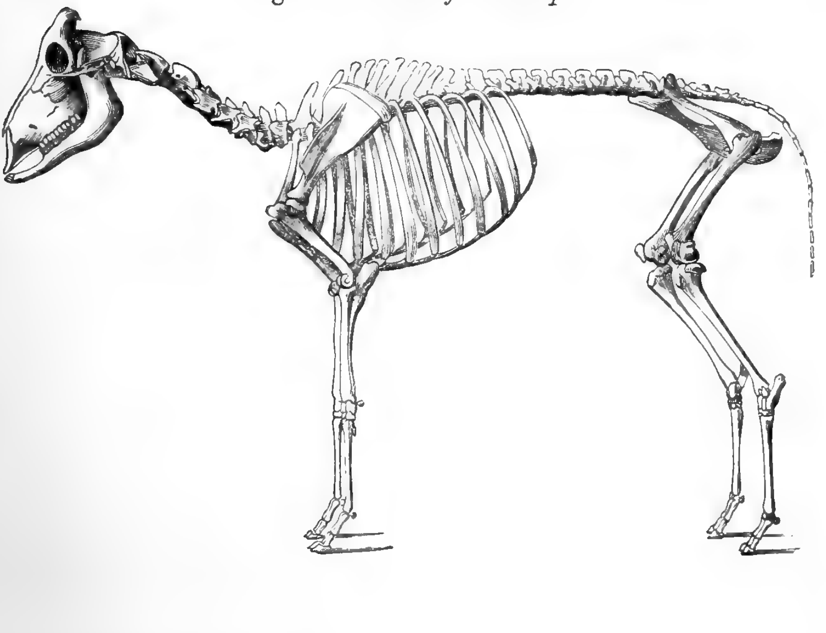
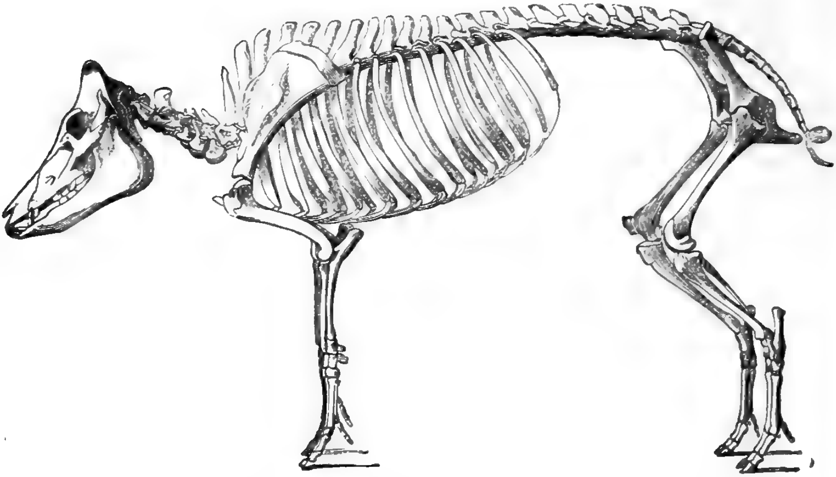


Fig. 4.—*Skeleton of the Pig.*



At the first glance there is a sameness in the general appearance of the bony framework which is wanting in the living animals. In fact, putting size out of the question, there is a strong likeness in skeletons of farm animals, and in these drawings no attempt is made to indicate the relation between the several specimens in regard to size.

It is not likely that the farmer will try to master the names and other details of the several bones, but he may easily note the chief regions. First, the head, which is formed of numerous bones joined together. The upper and lower jaws, with the teeth. The cavities of the mouth, nostrils, and orbits (eye cavities), and at the upper part of the head the cavity, completely surrounded with bone, which contains the brain.

A long chain of bones reaches from the head to the end of the tail; and seeing these, the observer knows that he is looking at the skeleton of a vertebrate animal. This chain of bones is divided into neck, joining the head to the trunk; back, reaching to the last rib; loins, going as far as the hip; then the sacrum and the bones of the tail.

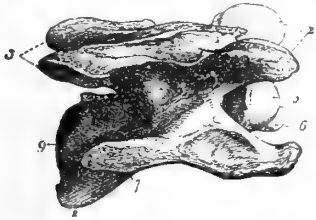
In the neck, long or short, there are seven bones, most of them of the form shown in Fig. 5.

Bones forming the back vary in number in different animals: horse, 18; ox and sheep, each 13; pig, 14. These bones differ as to the length of the upper spines, but generally they are of the form shown in Fig. 6.

To the dorsal or back-bones the ribs on each side are joined,

forming by their union with the breast-bone, or sternum, the bony boundaries of two large cavities, that of the chest (thorax) chiefly, and partly that of the belly (abdominal cavity).

Fig. 5.—*A Cervical Vertebra.*



1, upper spine; 2, front joint surface; 3, back joint surface; 5, front convex head; 6, 7, transverse spines; 8, lower spine; 9, concave surface of the body.

Fig. 6.—*Type of a Dorsal Vertebra.*

The small figures show the spines which project from the body of the bone; and the points of junction with the ribs. The special feature is the long upper spine.

Six bones of the loins (Figs. 7 and 8) form part of the chain from the last back-bone to the hip-bones. The loin-bones are

Fig. 7.—*Upper Surface of the Bones forming the Loins—showing the long Side Spines.*

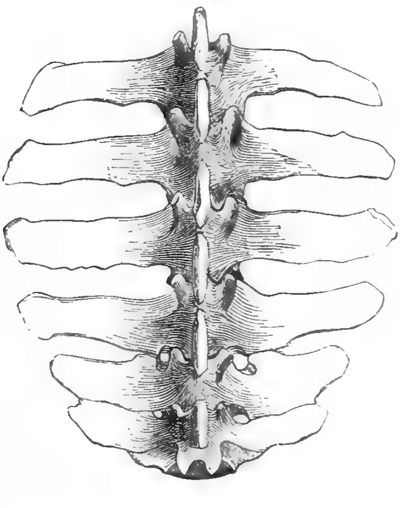
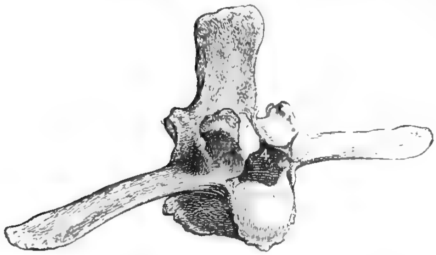


Fig. 8.—*Single Loin-bone, front view—showing the Upper Spine as well as the Side Spines.*

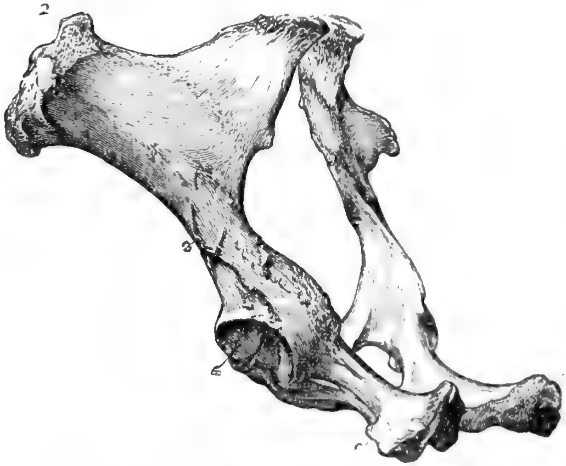


known by their long side-spines, which serve to partly fill up the gap left between the last ribs and the hips.

These figures show the loin-bones together, and also a single one. Next to the loins is the sacrum (Fig. 9), which is made

Fig. 9.—*Side View of Bones forming the Sacrum.*

Fig. 10.—*Side view of Pelvis.*



1, process forming hip; 2, point of the croup; 3, shaft of the hipbone; 4 cavity for head of thigh-bone; 6, spine of ischium.

up of several pieces joined together; then the bones of the tail, which complete the chain.

Figures 9 and 10 show the sacrum, and the hip-bone which rests on it, forming the cavity of the pelvis in which the genital and part of the urinary organs are lodged.

After the head, neck, and trunk, the limbs, hind and fore, are to be studied in the drawings of the skeletons. In the fore-limbs the observer may notice the shoulder-blade and the bone of the arm forming an angle with it, both of them joined to the trunk by the aid of flesh (muscle), there being no bony bond of union in any of the animals of the farm. Next to the arm is the fore-arm, consisting of two bones, the back one of which forms the point of the elbow. Then the knee-joint is reached (corresponding to the wrist of man), a very complex joint, as the next figures (11 and 12) show:—

Fig. 11.—*Posterior view of the Right Carpus.*

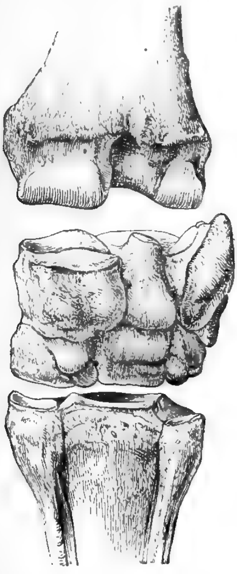
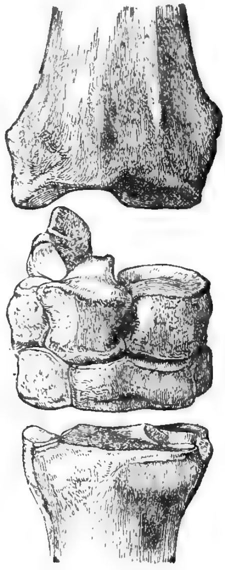


Fig. 12.—*Front view of Right Carpus.*



Immediately below the knee is the cannon-bone, or shank-bone, with the small splint-bones in the horse; and the bones of the pasterns, which really belong to the foot, although, as farm-animals walk on the tips of their toes, it is usual to limit the term "foot" to those points. The next figures (13 and 14) represent the bones below the knee, forming the fetlock, coronet, and coffin-joints, by their union one with the other.

Fig. 13.—*Side view of Bones below the Knee (Horse), viz. the end of the Shank-bone with the two floating Bones (Sesamoids) behind, the Large Pasterns, the Coronet Bones, the Pedal Bone, with the Navicular Bone behind it.*

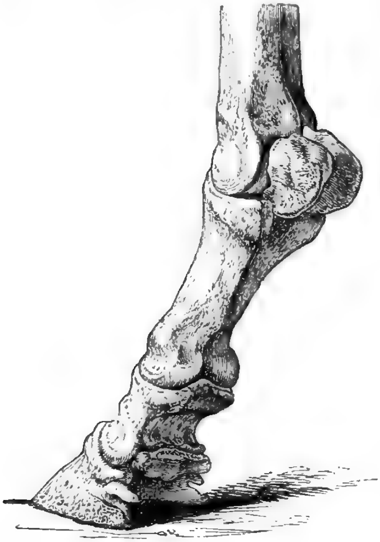


Fig. 14.—*Back view of the same Bones.*

Compare these figures of the bones below the knee of the horse with the next (Fig. 15), which shows the type of the similar bones in the limbs of the ox and sheep.

And again, compare the last figure (15), with the drawing of the same bones from the dog (Fig. 16), in which the bones below the knee are split into five pieces instead of being divided through the centre only.

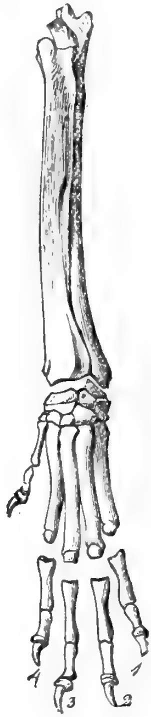
In passing, it may be remarked that the highest type of form of the limbs is that in which the last bones are divided into five fingers or toes. This subject is interesting, but too intricate to be further considered.

The hind limbs, it will be seen in the skeleton, are joined to the trunk by actual contact of bone, the junction being at the hip-joint, which is formed with the bone of the thigh and the hip-bone. Next to the thigh-bone there are the leg-bones, forming with the thigh-bones the stifle-joints (the knees of man); then the hock-joint (ankle of man); and below, a set of bones similar to those which have been referred to in the description of the fore-limb.

Fig. 15.—*Fore-arm and Foot of the Ox—front view.*

2, 3, bones of fore-arm (ulna and radius); 4 to 8, bones of knee; 10, shank-bone. The bones below the fetlock are divided through the centre into two parts.

Fig. 16.—*Bones below the Knee divided into five parts, ending in Four Fingers and a Thumb.*



Bones are very important organs in the animal-body. They form a solid base on which flesh and fat are conveniently supported. By their junction with each other, joints are formed which are essential to motion from place to place. They also form boundaries of cavities in which all the vital organs are contained, secure from risk or injury.

Dissection of a Carcass.

Under ordinary circumstances, with some knowledge of the bones and their uses to start with, the farmer may with some confidence aspire to a post-mortem examination, and if he desires to see the most which can be seen by the rough-and-ready method of cutting up which is possible in a field or shed, he will arm himself with a strong knife, with a blade some six inches long; a sharp saw, a foot long, without a back; and an iron hook, to use instead of his fingers, to hold any parts which it may be necessary to lift up or remove.

The Skin.—First, if the animal's hide is worth saving, it must be taken off carefully, and put on one side, but not without a few thoughts as to its structures and uses.

On the surface the hair or wool is seen coloured variously, differing in texture and character in different animals, forming a protective covering to the body.

The skin itself seems to be a mass of dense fibres, closely woven together; but if a very thin slice be cut quite through it, and put under a magnifying glass, it will be found that it has many parts, all of which have their uses.

In Fig. 17 the several tissues of the skin are well shown.

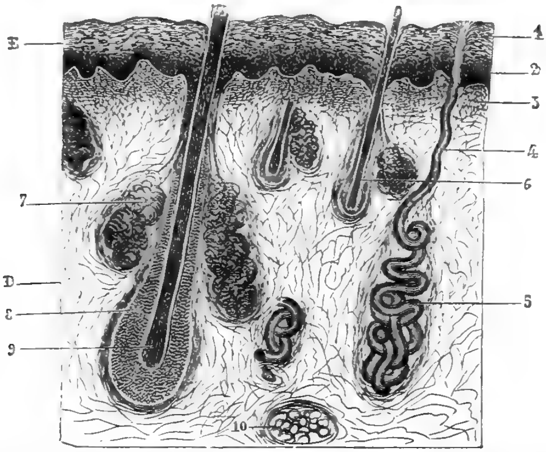
At the upper portion of the figure is the scarf-skin (cuticle), which is made up of cells flattened into scales, arranged like tiles on the roof of a house, covering the sensitive structures beneath. This same structure forms in certain parts of the body a still more dense substance, hoof or horn.

Under the scarf-skin or cuticle is the true skin, with the hair-tubes, sweat-glands and their tubes, and the glands which secrete a yellow waxy matter, which is very abundant on the skin of the sheep, and is known as the "yolk" (sebaceous matter). Sweat-tubes end on the surface of the skin, and so do the hair-tubes. The tubes which carry the "yolk" usually end in the hair-tubes.

To the naked eye the surface of the skin seems to be quite solid. It is really, to use a common expression, "full of holes." The sweat-tubes alone in a square inch of the palm of a man's hand amount to 3528, and if pulled out straight and joined

together, would form a pipe $73\frac{1}{2}$ feet in length. If all the tubes of a man's skin were thus joined, a pipe of 28 miles long would be the result, according to calculations made by Sir Erasmus Wilson.

Fig. 17.—*Section of Horse's Skin. From Wing of the Nostril.*



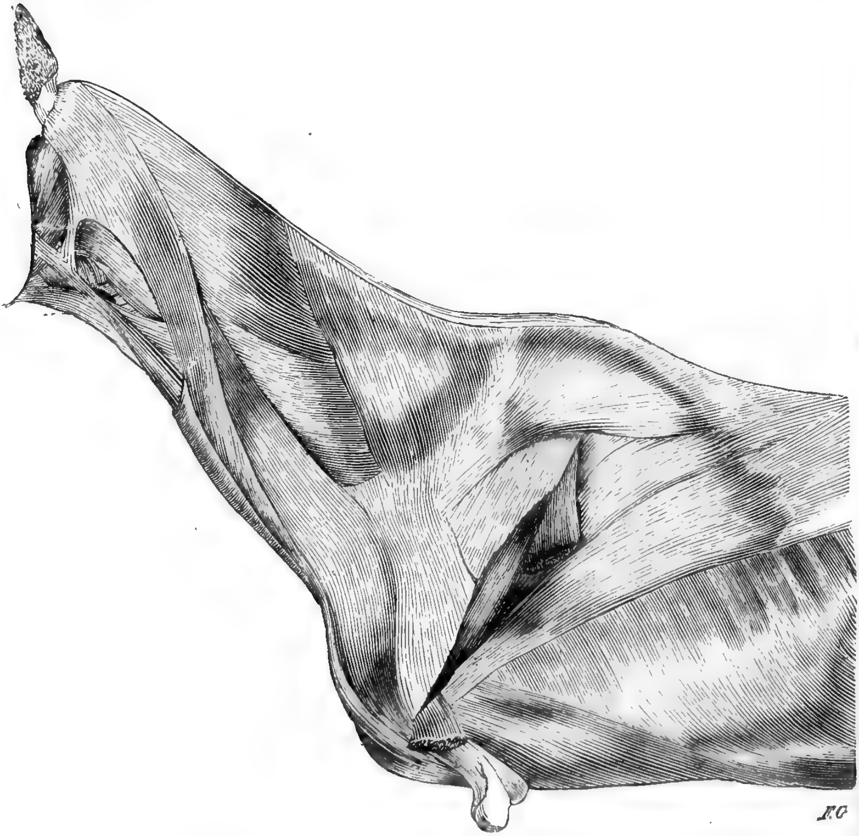
E, cuticle; D, true skin (derma); 1, horny layer of cuticle; 2, cell structure above the vessels of the true skin; 3, vascular layer; 4, duct of a sweat gland; 5, gland which excretes sweat; 6, hair follicles; 7, sebaceous gland; 8, internal sheath of hair follicle; 9, bulb of the hair; 10, mass of fatty tissue.

Uses of the Skin.—With the facts above stated in his mind, the farmer will lay aside the hide with something like a feeling of respect for a structure so complex and important; and this feeling will be increased by the thought of the great work which the skin has to do. First, as a guard to the tissues beneath, keeping them from injury; next, as a vast drain through which a great part of the waste of the body is poured out along with the sweat, which is always being given off, either as a vapour or a liquid, from the sweat-tubes, running off the skin sometimes in streams, or passing as a gas into the air without being seen; in either case regulating, by the process of evaporation, the heat of the animal's body. Lastly, the skin and hair deserve a thought, as the structures which put the finish on the animal's form. The old saying that "beauty is but skin deep," would, perhaps, be keenly felt by a stock-owner who stood by the carcass of a prize ox after the hide had been removed.

Muscle (*Flesh*).—The carcass deprived of the skin presents many points worthy of notice. A large part of the exposed surface is covered with red flesh, with fat here and there, and white glistening fibre; of these the red flesh is the most interesting.

This substance is known to the anatomist as muscle, and consists of fibres arranged in bundles of various forms and sizes, and is not a mere mass of *meat*, as it appears to be at the first glance. Fig. 18 shows the neck and part of the trunk of a horse from which the hide and a good deal of fat and white fibre have been removed, so as to make the outlines of the separate masses of flesh (muscle) quite distinct.

Fig. 18.—*Superficial Muscles of the Neck, region of the Shoulder, and part of the Back (Horse). The dark lines are the outlines of the separate muscles, which have distinctive names, according to their forms and uses.*



Uses of Muscle.—A good anatomist knows the form, size, and attachment of every one of the bundles of red fibres which form the flesh of the animal, but this knowledge is not to be expected of the farmer; he, however, should know what is the chiefly

interesting thing about the fleshy structure, its peculiar power of contracting. The contraction or shortening of the muscles may be seen during the cutting up of the carcass, if the animal has just been killed ; indeed it cannot escape notice, because every time the muscle is touched it jerks and moves quickly and with some force, so as to give rise to the idea, and cause often the expression of it in words, that the structure is alive, which is quite true, although the animal of which it forms a part is dead.

Muscle (flesh) is the structure by which all the motions of the animal body are carried on. Some of the actions are due to the animal's will; but many very necessary things are done by the muscles themselves, directed by the nerves, without the animal knowing anything about the matter. The circulation of the blood, breathing, the motions going on in the intestines —the muscles of which are white instead of red—are all done without any effort of the animal, and some of them without its knowledge.

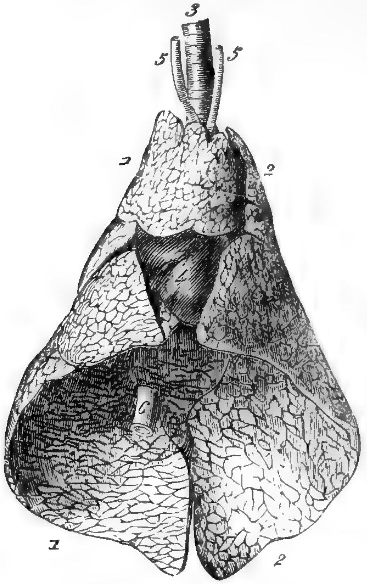
Breathing Organs.—Having observed the muscle, fat, and white fibre on the surface of the skinned carcass, the operator should next remove the fore-limb on the side most convenient to him by cutting through the flesh (muscles) which joins the shoulder to the trunk. Next, he should cut through the flesh or muscles at the upper part of the trunk, about six inches or a foot from the centre of the back, according to the size of the animal, all along the ribs to the flank, and with his saw cut through the ribs along the same line. A second cut with the saw along the lower portion of the ribs, where they join the breast-bone (sternum), will enable him to carry his knife along the lower part of the ribs, right up to the line at the top of the trunk which he began with, and thus to expose the whole of the cavity of the chest, leaving the abdominal cavity still closed. By the removal of the wall of the chest the operator has exposed the chief breathing organs—the lungs ; and by cutting through the windpipe and some large vessels, and also through the connection between the sac which invests the heart and the breast-bone, the lungs, heart, and large vessels can be lifted out of the chest for nearer inspection.

In Fig. 19, p. 32, the lungs and heart of a sheep are shown as they appear when taken from the chest in the manner described.

To be perfectly healthy the lungs should be smooth on the outside, of a clear pink colour ; they should yield easily to pressure, and to the touch should give the idea of being filled with air.

Not resting satisfied with the outside appearance, the observer should cut open the piece of windpipe which is attached to the lungs, and continue the cutting along the divisions of the tubes as they extend into the substance of the lungs. It will not

Fig. 19.—*Lung of the Sheep* (*inferior view*).



1. Right lung.
2. Left lung.
3. Windpipe.
4. Heart.
5. Arteries (carotid).
6. Large vein (vena cava posterior).

be possible to explore all the tubes (bronchial tubes), because they are very numerous, as Fig. 20, showing the divisions of only one bronchial tube, will indicate.

In the course of this examination the farmer will note that the tubes, if healthy, are quite empty, and the lining membrane is of a pinkish-yellow colour, covered with clear mucus. If any foreign bodies, or any parasites, as the thread-worms, which often infest these tubes, are present, they will be seen without difficulty.

To complete the inspection of the organs of breathing, the portions of windpipe in the neck must be traced up to the back of the mouth, where it ends in the organ of voice (larynx), shown in the next figure (21).

Through the mouth and nostrils there is free communication between the larynx and the outer air. The horse, owing to the great size of the soft palate which shuts off the mouth, only breathes through the nostrils.

Uses of the Breathing Organs.—Breathing is by most people looked upon as the essential vital function; and it may be allowed that it is rather more concerned with the continuance of life than other functions are, as proved by the fact that when the circulation and brain have ceased to act, the life may be saved for a time by keeping up the breathing by artificial

Fig. 20.—*Bronchial Tube, with its Bronchules and ultimate Ramifications (natural size).*

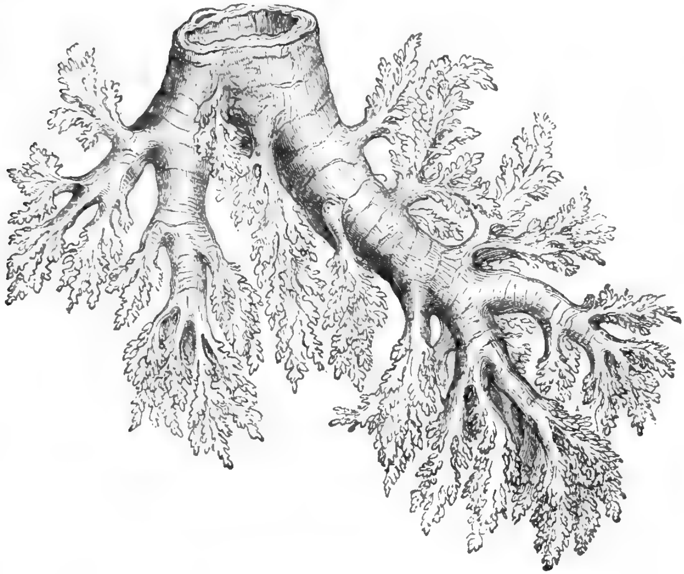
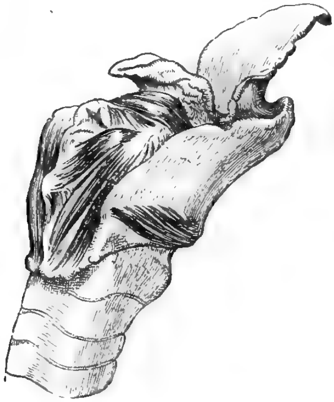


Fig. 21.—*Postero-lateral view of the Larynx.*



means. As people understand the process, breathing consists in drawing air into the chest and driving it out again so many times in a minute; but without going too far into the science of the matter, it is necessary to get beyond this very bald view.

First, as to the number of breathings in a given time, there is much to be noted. A man at rest is said to breathe, that is, to take in (inspire) and drive out (expire) air, the double action

being counted as one, fifteen times in a minute. A horse in the same state breathes eight to ten times in a minute. An ox is said to breathe fifteen to twenty-five times in a minute; but if the farmer will do as the writer has often done, count the breathings of cattle when at rest at different times of the year, he will find that in hot weather, or in winter in a warm shed, thirty, forty, or fifty breathings in a minute are not uncommon; and he will very likely be as much surprised as the writer was to find healthy sheep breathing from thirty to two hundred times in a minute when at rest. Pigs seem to maintain a tolerably steady rate of breathing from fifteen to twenty-five times in the minute. Great differences in the number of breathings are therefore to be expected in farm-stock in good health.

Of more consequence than the number of breathings in a minute is the mode in which the act is done, and above all is the result of the process to the animal body. If the farmer will look at the carcass from which he has taken the lungs, he will note that he has cut through a good many muscles in taking off the wall of the chest, and at the back of the cavity which contained the lungs he will see projecting forwards a partition of red muscle and white glistening fibre which separates the chest from the cavity behind it (abdomen). He may recognise the muscular partition as the skirt; the anatomist calls it the diaphragm.

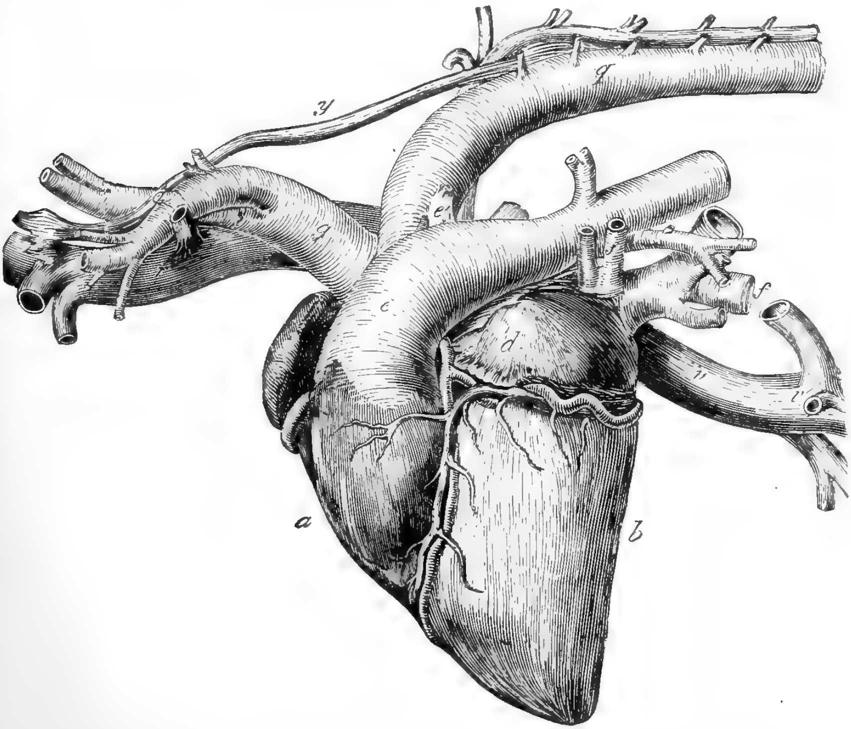
In the act of breathing-in the air (inspiration) the walls of the chest are pulled upwards and outwards by the contraction of muscles attached to the ribs, and at the same time the diaphragm contracts and pulls the centre, which projects into the chest, backwards, and thus the space in the chest is much increased. The pressure of the air in the chest is now less than that outside, and as a natural result the outside air rushes into the nostrils or mouth down the windpipe into the lungs.

When the lungs are filled, the muscles cease to contract. The walls of the chest and the diaphragm go back to their former position, and the excess of air is pressed out, the expulsion being aided by the contraction of the muscles of the flanks. But it is important to inquire what has happened during the entrance and exit of air.

First, it must be remembered that the lungs are not emptied of air by the act of breathing out; in fact they are always fairly full of air, and the air in the lungs is always giving up some of its oxygen to the blood, and getting back some carbonic acid from the blood, and some watery vapour and certain worn-out materials in exchange—a bad exchange for the air in the lungs, but a very good one for the blood, which becomes again fit for use in consequence.

In the act of breathing, air from without, comparatively pure, passes into the impure air in the lungs, and some of it remains, mixing with the air which is already there; so that when the breathing-out occurs, the air which comes from the nostrils or mouth contains less oxygen and more carbonic acid than the air which was inspired. The process is very simple, and not, from a mechanical point of view, very perfect in its results; it really amounts to this: the air in the lungs is always getting noxious matter from the blood, and always receiving at short intervals, many hundreds of times a day, a little good air from outside to mix with the bad air within, and sending forth much of the good air along with a little of the bad. The air in the lungs is never pure, never indeed very much the better for the little pure air which it gets; but it is bound, for the life of the animal, not to get any worse. A certain standard of impurity is allowed, but it must not be exceeded.

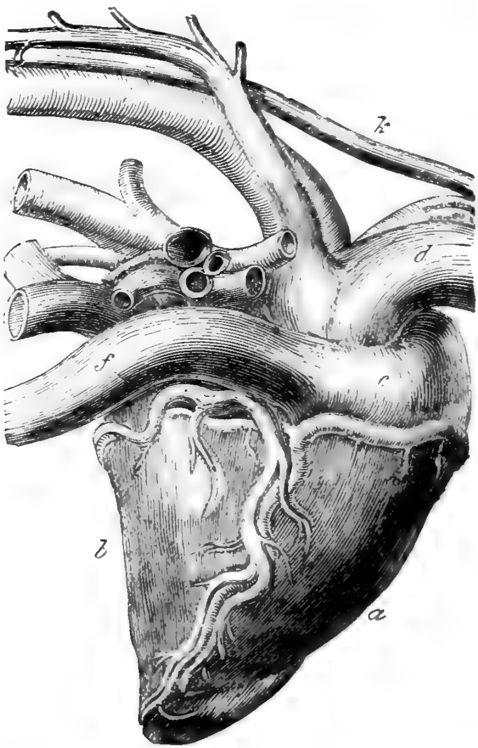
Fig. 22.—*The Heart and principal vessels, left face.*



a, right ventricle; *b*, left ventricle; *c*, right auricle; *d*, left auricle; *e*, artery going to the lungs; *f*, veins coming from the lungs; *g*, anterior large artery (aorta); *q*, posterior large artery (aorta); *r*, large vein bringing blood from fore parts of body (anterior vena cava); *v*, posterior cava bringing blood from hinder parts of body; *y*, thoracic duct.

Organs of Circulation.—Having given a little time to the consideration of the structure and uses of the breathing-organs, the observer next turns his attention to the heart, of which he has some general knowledge chiefly in regard to the external form, size, and colour. The organ, however, as the centre of the circulatory system, deserves a little further consideration, if only so far as may be necessary to make the inquirer understand that the apparently solid mass of muscular or fleshy structure of conical form has four distinct cavities, the openings into which are guarded by valves perfectly arranged to allow the blood to flow in one direction, and to check the attempt to go in any other. If the heart and its large vessels can be got out skilfully, as a good dissector would do the work, it will appear as in Fig. 22 (p. 35) and Fig. 23 (below), which show both sides of the organ as it hangs in the chest.

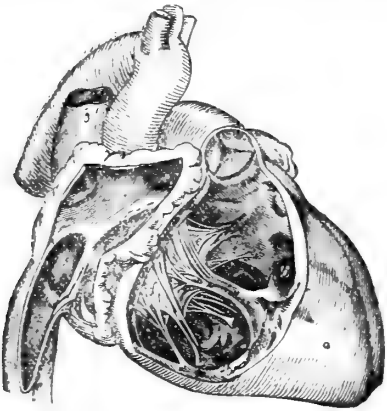
Fig. 23.—*The Heart and principal vessels, right face.*



a, right ventricle; *b*, left ventricle; *c*, right auricle; *d*, anterior vena cava; *f*, posterior vena cava; *k*, thoracic duct, which carries the lymph poured into it by the absorbents into the large anterior veins, where it mixes with the blood going to the right auricle.

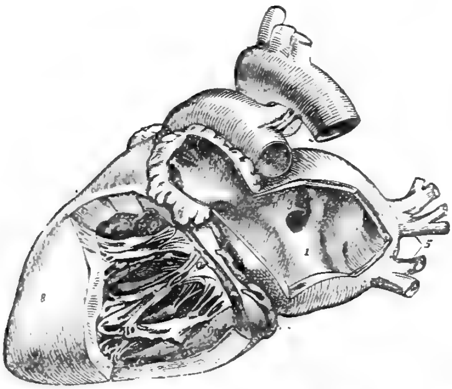
For the purpose of getting an idea of the form and arrangement of the inside of the heart, portions must be cut from each side, as represented in Figures 24 and 25, which, with the short description, will enable the observer to get a better notion of the structures shown in the cavities which he has exposed than he would gain from a large volume of verbal description only.

Fig. 24.—*Right side of Heart laid open.*



1, cavity of right auricle; 3, anterior vena cava opening into the right auricle; 4, posterior vena cava: *a*, right ventricle; *b*, its cavity; *e*, *f*, valves between the right auricle and right ventricle to prevent return of blood when the ventricle contracts.

Fig. 25.—*Left Cavities of Heart laid open.*



1, cavity of left auricle; 3, openings of two right pulmonary veins; 5, left pulmonary veins (these vessels take the blood from the lungs into the left auricle); 8, left ventricle; 9, 9, its cavity; *a*, valve (mitral) between left ventricle and left auricle.

Uses of the Heart and Vessels.—To trace the large vessels which are attached to the heart to their small branches can only

be done by an expert dissector. The practical man must therefore accept the statement that the arteries go to all parts of the body from the ventricles, to carry good blood for their support and repair, or bad blood to be purified. The veins begin with small branches, which join together as they get nearer the heart, until at last there are only two large ones, which receive the blood after it has done its work, and become mixed with various impurities, and take it into the right side of the heart.

Of the action of the heart and blood-vessels everybody has some general ideas. It is well known that the heart is the organ which drives the blood over the body, and experiments have shown that the force which it can exercise is sufficient for this purpose. When the left ventricle of the organ contracts, the blood which it contains is forced into the arteries already full of the fluid, and the whole mass of blood is moved onwards with a bound which distends the elastic vessels, and is felt all over the system in the beats of the pulse, which take place with remarkable regularity when the animal is at rest and in health, but undergo great changes in number and force under excitement, or during the course of disease.

For practical purposes the following numbers may be taken as generally correct. Number of pulse in a minute: horse, 36; ox, 55; sheep, 75.

The right ventricle of the heart contracts at the same time as the left one, but with less force, as it only has to send the blood which has already gone over the body and given up a good deal of its best material, taking in exchange a lot of bad, to the lungs, where it can get rid of the waste matters, carbonic acid, and other products of combustion, and get a fresh supply of oxygen, before it is returned to the left side of the heart to be pumped over the body. This movement of the blood from the right side of the heart through the lungs to the left side, is described as the LESSER CIRCULATION. The pumping of the fluid from the left side of the heart through the vessels of the system back to the right side of the organ is the "GREATER CIRCULATION."

From the minute hair-like tubes (capillaries) in which arteries end, the portion of the blood which contains all the nutritive elements is constantly leaking into the tissue, which use what amount of it they require, while the rest is taken up into the absorbent vessels (lymphatics), and again is poured into the blood on its return to the heart through the veins by the thoracic duct (see *k*, Fig. 23, p. 36). The blood is therefore always giving up something to the tissues, and always getting something back again from the absorbents, the total result being that the blood-vessels get rid of the whole quantity of blood

which they contain, and get back a similar bulk of new fluid about every twenty-four hours. But, like the air in the lungs, the fluid is never entirely good nor altogether bad; it is constantly giving up its best materials, and as constantly getting back a mixture of good and bad. The good to be used for the support of the structures, and the bad to be excreted from the skin, kidneys, intestines, and other excretory organs, whose beneficent action is continuous, indeed cannot be interrupted for a short time even without damage to health, if not risk of life.

Organs of Digestion.

Organs of Digestion.—To get the full benefit of the inquiry into the organism of the dead animal, which has served to illustrate the structure and uses of the breathing and circulatory organs, it is now required that the abdominal cavity be opened, by cutting away the flank. The organs which will be exposed to view will vary, according to the kind of animal which is under examination, and the side on which the carcass is lying, and it will generally be the easiest plan to remove the stomach and intestines from the cavity in which they are lodged, and spread them out for inspection.

In the ox and sheep the stomach forms, with its four divisions, the chief bulk of the digestive organs, the intestines being small in comparison.

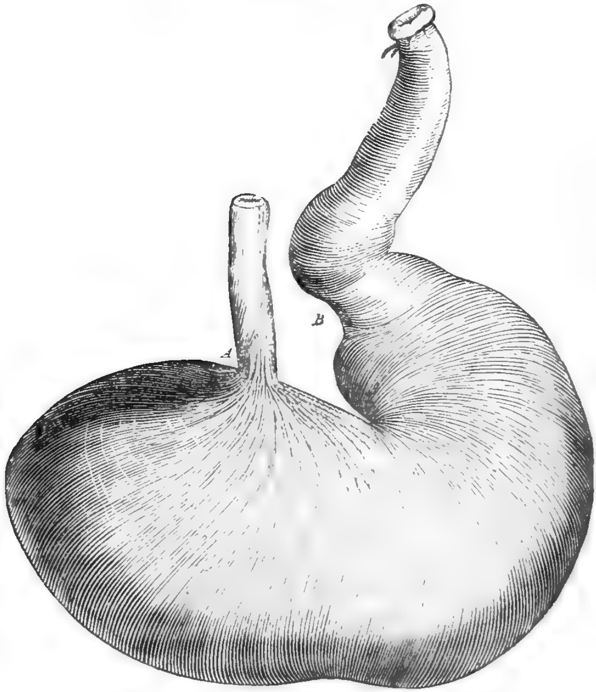
While the contents of the abdominal cavity are being removed, it will be noticed that the stomach is joined to a red tube, which is the gullet (œsophagus), running through the skirt (diaphragm), along the lower part of the neck above the windpipe to the back of the mouth, where it expands into a sort of funnel (pharynx).

Returning to the abdomen, it will be noticed that the cavity and all the organs in it have a covering of smooth, moist membrane (peritoneum), which, in the form of folds, suspends the different organs and keep them within certain limits, one large fold, extending over a considerable part of the intestines, is seen at once, from the fact that it contains a good deal of fat, called flare; this structure is known as the great omentum. Then a large fold of the membrane (mesentery) suspends the intestines from the spine, and along it all the vessels pass which go to and from the intestines. In the horse the stomach when cut from its attachments presents the form shown in Fig. 26, p. 40.

The stomach of the pig bears a close resemblance to the stomach of the horse, but it is less curved on itself, and of course is smaller.

When cut open, the stomachs of all animals show a structure which is quite different from the outside. The lining is known as mucous membrane, and may be described shortly as an altered form of the skin which covers the surface of the body, having numerous tubes opening on it from which a quantity of fluid (mucus) is constantly flowing. The mucous membrane may in fact be called the inside skin which extends from the surface of the body, from the mouth all through the swallow, the stomach and intestines, and through the nostrils, through the windpipe and all the breathing-tubes.

Fig. 26.—*Stomach of the Horse.*



A. Portion of swallow; B. Commencement of small intestine.

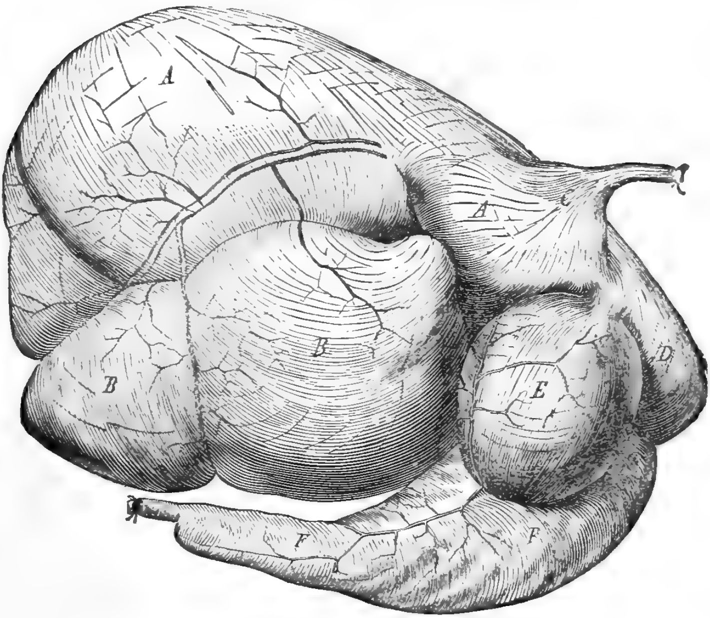
If the carcass which is under examination is that of an ox or sheep, the stomach will present the appearance seen in Fig. 27.

The chief compartment of the stomach in the ox and sheep (rumen) occupies a large part of the cavity of the abdomen; indeed, very little else can be seen until the stomach is removed. A small compartment in front of the paunch, the reticulum, is distinguished by the peculiar honeycomb form of its lining

membrane. The third compartment is on the right side next to the reticulum, and is well known as the "maniplies" (omasum), from the fact that its lining membrane is in the form of leaves or folds, which run lengthwise of the organ.

The fourth compartment is called the reed or rennet (abomasum), and is the true digestive stomach in which the gastric juice is formed.

Fig. 27.—*Stomach of the Ox, seen on its right upper face, the Abomasum being depressed.*



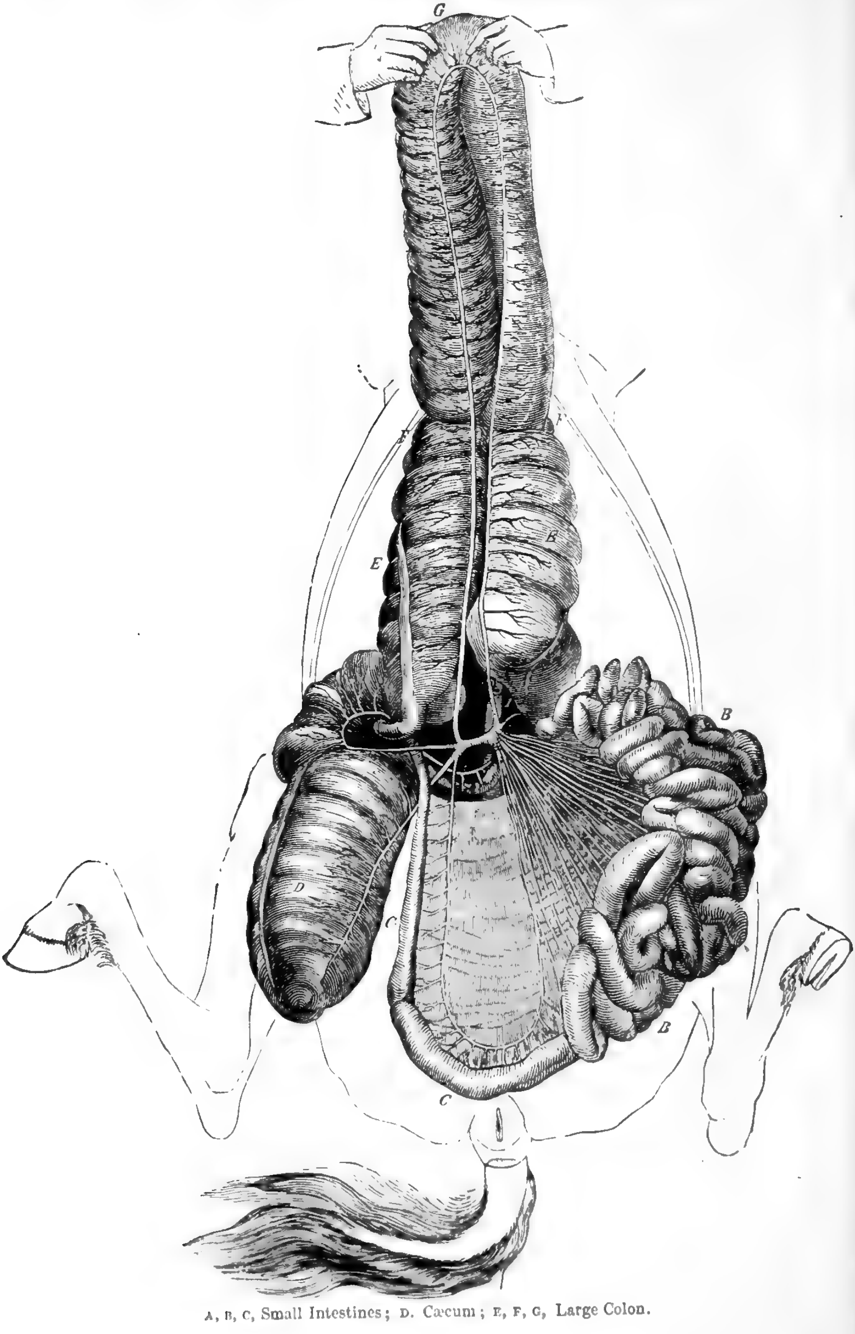
A. Paunch (rumen); B. Right half of it; C. Swallow; D. Reticulum; E. Omasum. F. Abomasum.

From the opening of the stomach furthest from the entrance of the swallow, the intestines extend as a long twisted tube, varying in size at different parts, giving rise to the terms "large" and "small" intestines. The small intestines commence from the stomach and end in the large intestines.

Some idea of the arrangement may be found by reference to Fig. 28, p. 42.

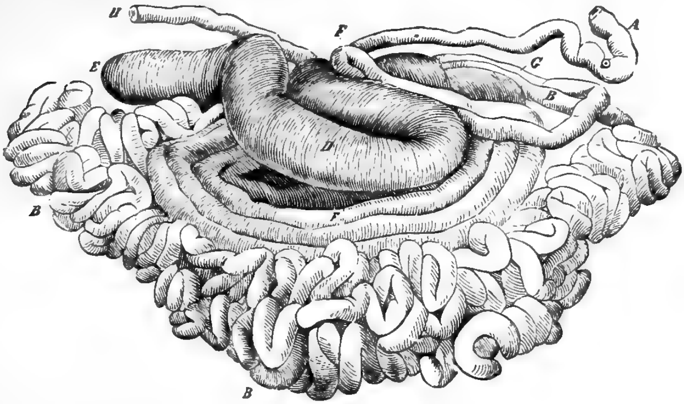
In the next drawing, Fig. 29, p. 43, which represents the intestines of the ox, it will be noticed that the cæcum and colon are relatively smaller than in the horse, while the small intestine is longer, having an average length of 49 yards, which is twice the length of the intestine in the horse.

Fig. 28.—*Distribution of the Great Mesenteric Artery.*



A, B, C, Small Intestines; D. Cæcum; E, F, G, Large Colon.

Fig. 29.—*General view of the Intestines of the Ox; right face.*



A. First intestine (duodenum); B. Loose or floating portion of small intestine; D. Cæcum; E. Its point directed backwards; F. Large colon; G, H. End portion of the intestine.

Three organs in the abdominal cavity are to be seen after the stomach and intestines have been removed; two of them belong to the digestive system, the liver and the pancreas (sweetbread), and one, the spleen or milt, occupies an office of somewhat doubtful nature.

The liver is a large gland, the general appearance of which is familiar to every one; its work is to secrete the bile, which is poured into the first intestine through a tube or duct, and in most animals a part of the secretion is stored up in the gall-bladder, which does not exist in the horse.

The pancreas is placed in front of the kidneys. In structure it resembles the glands in the region of the head which secrete the saliva, and in function it is somewhat allied to them. Two ducts or tubes pass from the pancreas to the intestines; one, the larger one, enters the intestine with the bile-duct, and a smaller one enters the intestine opposite the entrance of the other one.

Spleen or milt is the name given to a long narrow organ lying against the diaphragm, in contact with the large curvature of the stomach. It is remarkable for the number and the size of its blood-vessels. To the farmer it will be interesting as the organ which is most affected in splenic fever.

Uses of the Digestive Organs.—On the right performance of the digestive process depends the success of the efforts of the farmer to produce his stock on the market in a fit state for the butcher; digestion means in effect the changing of the food on which an animal lives into the materials which build up its tissues, and, without going too far into the details of the

function, it will be instructive to trace a portion of food from the mouth into the blood stream, which will carry it all over the system.

Food is first grasped by the lips, or teeth, or both, and broken or ground up, mixed with the saliva, which softens it, besides setting up a fermentation which ends in the change of starch into grape sugar. The softened and altered food is swallowed, and in the stomach further changes go on; the albuminoids are there changed into more soluble compounds (peptones), which pass easily through the membrane which forms the walls of the minute vessels. From the stomach the food passes into the first intestine, and is mixed with the bile and pancreatic fluid, which cause further changes. The bile prevents too rapid decomposition, and also promotes the absorption of fat, and helps to dissolve a lot of waste matters from the intestines. The pancreatic fluid acts on the fats, and continues the change of starch into sugar. As a total result, the elements of the food are reduced to a state fitting them for absorption into the blood, and a large proportion of the soluble parts of the food are at once taken up by the small blood-vessels (capillaries) of the intestines. The fatty matters, with other portions of the food forming a white fluid like milk, are taken up by the special absorbents (lacteals), which carry them into the blood stream going towards the heart; all that part of the food which is not dissolved and taken into the blood is carried into the large intestine, and expelled in the form of manure.

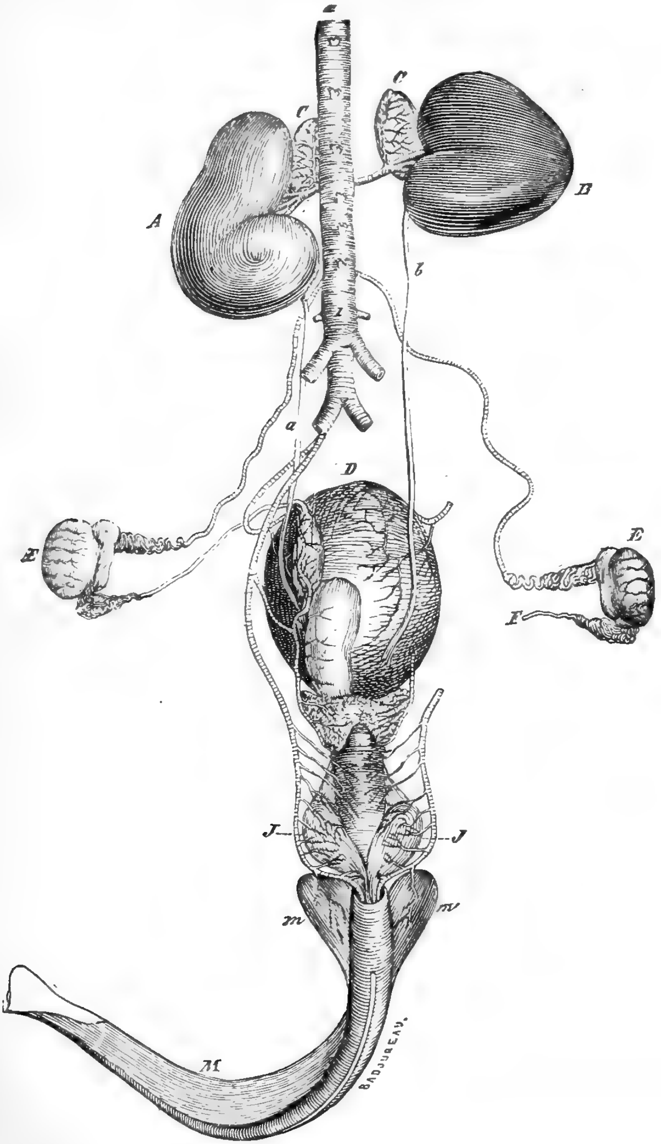
Ruminants, as the ox and sheep, swallow their food after a little chewing; and then, when the paunch is well filled, they rest, and re-chew the mass in small portions at a time, after which it passes through the other divisions of the stomach into the true digestive organ, where the same action takes place as goes on in the single stomach of the horse or pig.

Urinary and Generative Organs.—It will not be possible for the farmer to get more than a general idea of the situation and form of the organs of the urinary and generative systems during the rough dissection of the carcass.

When the stomach and intestines are taken out of the cavity of the abdomen, the kidneys, or at least the fat which covers them in fat animals, will be seen; and from the pelvic cavity formed by the hip-bones, the bladder, and in the female animal a portion of the womb (uterus), will protrude. These parts may be examined by sawing away a portion of the hip-bone on one side, or they may be cut out and placed on a table.

Fig. 30 shows at one view the urinary and generative organs of the male (horse).

Fig. 30.—*Superior and general view of the Genito-Urinary Apparatus in the Male, with the Arteries.*



A, B. Left and right kidney; *a*, *b*. Ureter; C, C. Capsules in front of kidneys; D. Bladder; E, E. Testicles; J, J. Prostate glands; *m*. body of penis. 1. Large artery of posterior aorta, from which branches are sent off to supply blood to all these organs.

In the female animal the most important of organs are the womb and its appendages.

Uses of the Urinary Organs.—It is the special office of the kidneys to remove from the system the results of the destruction of nitrogenous tissues, in the form of urea; and the importance of the work is proved by the fact that the retention of urea in the blood is always serious, and in a short time fatal. The bladder receives the urine which flows from the kidneys through two tubes (ureters), and retains it until enough is collected to cause the bladder to contract, when it is expelled, the process being, under ordinary circumstances a voluntary one, although in the lower animals it is usually carried on in obedience to the desire to relieve the sensation of discomfort which is the result of distension of the bladder.

Organs of the Nervous System.—At this point of the inquiry the farmer will find that his means of pursuing the study of animal organs are exhausted; he will not be able to make with his few tools a dissection which will disclose the brain and nerves to his view. All that can be done for him in this matter is to refer him to drawings and descriptions.

The next illustration (Fig. 31) will show how very complex the arrangement of the nervous system is, although in this drawing only one system, the sympathetic, is exhibited.

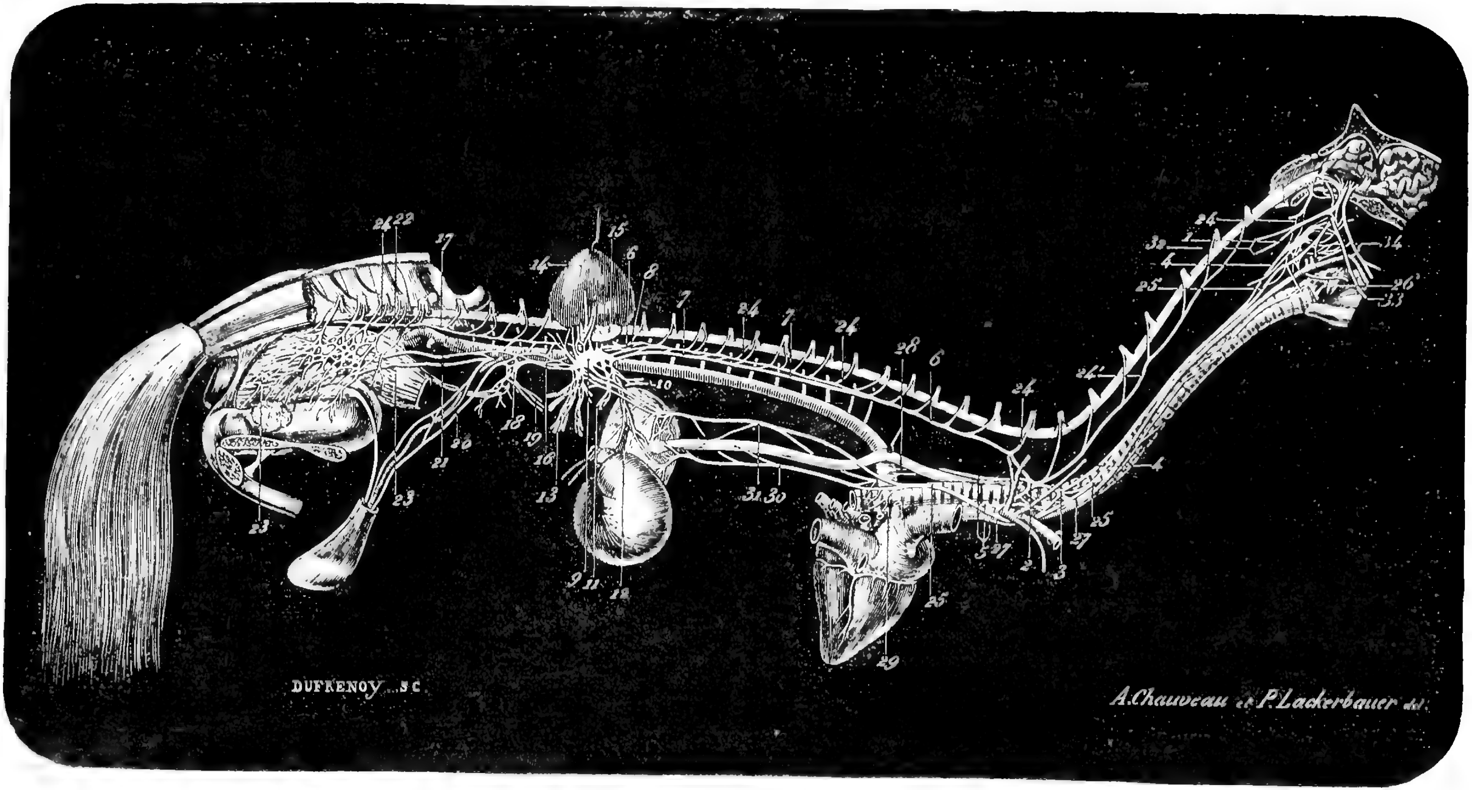
In this illustration the bony covering of the brain and spinal cord has been removed, so as to exhibit the roots of the nerves. The fine white lines show the branches of the great sympathetic nerve in connection with the nerves which proceed to the lungs, heart, and other organs of the body.*

Uses of the Nerve Organs.—The scientist would think it impertinent on the part of a writer if he were to suggest that even a mere vague idea of the work of the nerve-organs could be given in few and simple words, and in fact it would be out of place in this paper to go beyond the most elementary statements.

Nerve-organs are briefly the store-houses and carriers of force, and thus they regulate the whole work of the organism. If constant motive power is wanted, the nerves keep up the supply, as in the case of the heart. If an organ at rest requires to be set at work, the nerves are ready to conduct from a centre the force necessary to rouse it into action. Does an animal feel pain, the nerves of the injured part have only done their duty in carrying the impression from the part to the brain, to make the fact of the injury known. In fine, Consciousness—Will—

* It is not possible to give an explanation of the numerous parts which are indicated by the figures; the object is to show the intricate arrangement of the nerve fibres, without going into details.

Fig. 31.—*The Sympathetic System, partly theoretical.*



Motion—the whole round of functions of which the organism is capable, depend on the exciting and directing action of nerve-organs.

For those who desire to pursue the study to which the preceding remarks form a simple introduction, the following works will be found useful:—'Chauveau's Comparative Anatomy,' by Dr. George Fleming; 'Principles of Human Physiology,' by Dr. Carpenter; 'Kirke's Handbook of Physiology,' by Morant Baker. Of these the first-named is to be selected as the most comprehensive and useful for the student of anatomy in reference to the animals of the farm.

III.—*Pasteur and his Work, from an Agricultural and Veterinary point of View.* By GEORGE FLEMING, LL.D., F.R.C.V.S., Principal Veterinary Surgeon of the Army.

AGRICULTURE, in the widest and most comprehensive sense of the term, depends upon so many collateral sciences, as well as arts, for its continuous prosperity and progressive development, that any marked advancement or important discovery in these must react more or less beneficially upon it, and promote, to a commensurate extent, its welfare. Among the sciences which, for many years, have aided in this direction, perhaps it is not too much to claim for Chemistry a very forward, if not the foremost, place; and among the greatest chemists are those who have devoted at least a portion of their skill and time to the study of what has been termed "Agricultural Chemistry." The chemical composition of soils in relation to the food, growth, and health of plants; the food, feeding, and products of certain animals, as well as the preparation and preservation of many of those products for the use of man; the action of the atmosphere, heat, light, and moisture upon plants and animals; the artificial agents which may be made to second the efforts or supplement the exhausted powers of nature, whether in regard to the soil, the plant, or the animal body—in all these, and in other ways, chemistry has lent its powerful assistance to agricultural requirements, and it may truly be said that, without it, Agriculture would lose one of its best benefactors and most worthy helpmates.

In recent years, the science of Biology has also been bestowing more and more of its favours on Agriculture, and is now pushing Chemistry very hard for the first place in respect to the services it can render the oldest of all the arts, and more

especially with regard to the elucidation of the problems which surround plant and animal life, be that life in a normal or abnormal condition. And here, in mentioning biology, it is impossible to refrain from alluding to the vastly important and wonderful discoveries which have, within half a century, been made through the intelligent employment of, first, the simple, then of the compound microscope. So recently is the date of its most startling revelations, that I myself can remember a rather distinguished Professor of Medicine, not a quarter of a century ago, designating it a scientific toy, and deriding those who, as he expressed it, wasted their time and their eyes in foolishness. This optical instrument is now far more essential to the man of science, and to mankind in general, than the telescope; inasmuch as it reveals to us the presence of the infinitely little —myriads of minute plants and animals, strange organisms and delicate structures—which, until it was employed, were beyond the vision and the knowledge of man, all of which take a part in Nature's work, and many of which have a markedly benignant or malignant *rôle* in the vital operations of the higher plants and animals, they being active agents in the metamorphoses of matter—be it living or dead.

With the introduction of the microscope into biological investigation, a new world in which to make grand conquests has been given to the philosopher and the searcher into life's mysteries; the mysterious phenomena of life and death, growth and decay, building up and breaking down, and even the result of what were supposed to be purely chemical processes, are now within the range of man's scrutiny, and can be ascribed more or less to the operation of the impalpable, and hitherto invisible organisms, the existence of which this optical "toy" has now made us cognisant of. Even "the pestilence which walketh in darkness," destroying man and beast, has been robbed of its mystery by the penetrating light which this ingenious combination of lenses and optical accessories has shed upon it; and man may, by its aid, in time protect himself, and the animals and plants he rears, from disease and destruction, by the knowledge he has thus acquired. Indeed, to some extent this most desirable end has been already achieved; for some diseases, the nature of which was unknown, and in the prevention or cure of which we were simply groping in the dark, are now perfectly understood, and their prevention is based on this understanding; while we are able to make their active cause serve as a protective influence—make, in fact, the bane act as its own antidote—and thus obviate the necessity for resorting to uncertain, oftentimes dangerous, and generally onerous attempts at curing. No greater advance has perhaps ever been

made in the medicine of man and animals, than that which has taken place during this half of the nineteenth century; and to none among those who have contributed to this result is more credit due than to Louis Pasteur, by whom the greatest discoveries in the world of microscopic organisms have been made, the solution of intensely intricate and important problems effected, and the verities of nature—in her darkest and most baffling recesses—demonstrated in a manner which only genius of the highest order could suggest and execute.

It is only too often felt by those who strive to win Nature's secrets, that all the great problems in natural science—such as the nature of heat, of light, of electricity, of gravity—and still more, all questions connected with life, bring us in the end, and frequently after but a few steps, face to face with infinity and mystery. It has been Pasteur's happy lot to select, or rather to be compelled by destiny to follow, a course which has led to such grand achievements, and at every stage of which he has left his indelible and character-mark. His progress has been along the path which has been already trodden by men of great genius, and pursued unfalteringly through weary days and nights, but along which the love of truth burns as a pure and a guiding light—that *lumen siccum* which Bacon insisted should be found in all philosophers, and which, it would seem, neither failure nor disappointment can quench or dim. As a representative of modern science, Pasteur occupies an advanced position. Cicero has somewhere said, "Opinionem commenta delet dies, naturæ judicia confirmat;" and Pasteur in his work appears ever to have borne in mind that speculative opinions have but an ephemeral duration, whilst inferences drawn from nature and truth remain permanently on record.

Originally a chemist, by the force of circumstances and a most fortunate concurrence of events, this most distinguished man became a biologist, and finally a pathologist—startling chemists, physicists, crystallographers, and physicians, no less than agriculturists, with his discoveries, and conferring upon civilisation immediate and inestimable benefits in many directions, while opening up a wide region for the fruitful cultivation of other investigators.

However far-extending and diverse the effects of these discoveries may be, and are, the object of this paper is limited chiefly to a survey of their relations to and influence upon Agriculture, and to a notice of the circumstances and conditions under which they were made, and the benefits likely to accrue from them.

I have stated that Pasteur was originally a chemist; but it may be mentioned that his training in this science was conducted by Dumas at the Sorbonne, and by Balard at the École

Normale, Paris, under whom he became a very competent experimentalist. During his studies in chemistry, molecular physics appear to have proved very attractive to him, and at last to have deeply engaged his attention, the molecular condition of crystals forming the chief object of his investigations. The results arrived at in his inquiry, when only twenty-five years of age, into the symmetrical and unsymmetrical (or dissymmetrical) forms of salts apparently identical in chemical composition, were remarkable, and elicited the admiration of the chief authorities on this subject, and especially of the German chemist, Mitscherlich, who had failed to discover what Pasteur had succeeded in demonstrating, though he had devoted many years to it. The conclusion Pasteur came to was, that the unsymmetrical molecules of matter are produced by, or built up under, the influence of vital agencies, the symmetrical being characteristic of inorganic bodies, the two conditions being typical of the physical barrier that exists between organic and inorganic nature. This conclusion has, however, since been questioned, and Tyndall, twenty years ago, in his 'Fragments of Science,' was inclined to maintain that "it is the compounding, in the organic world, of forces belonging equally to the inorganic, that constitutes the mystery and the miracle of vitality."

It is very probable that had Pasteur continued to pursue his researches in chemistry and molecular physics, he would have attained special eminence, and these sciences would have greatly benefited. At the early age of thirty-two he was appointed Professor of Chemistry at Strasburg, and soon after (in 1854) was transferred to Lille, as Dean of the Faculty of Sciences in that town, where, for a time, he continued to labour, to verify, and to make deductions from theoretic views, until step by step he had discovered the startling connection that existed between his previous researches in chemistry and crystallographic physics, and the new and entirely unexpected results obtained in physiological chemistry—which connection finally led him, as if it were the thread of Ariadne, to his magnificent discoveries in pathology.

This series of successes was referred to by the celebrated Chevreul at the Academy of Sciences some time ago, when he said: "It is by first examining in their chronological origin the investigations of M. Pasteur, and then considering them as a whole, that we are enabled to appreciate the rigour of judgment of that learned man in forming his conclusions, and the perspicacity of a mind which, strong in the truths which it has already discovered, is carried forward to the establishment of new ones."

What might have been considered an accident, led Pasteur

to abandon his hitherto congenial and highly successful line of research in the domain of chemistry and molecular physics, and enter upon a new but not very dissimilar course, in which his great natural gifts and previous training were to confer such advantages. This was the very important study of fermentation, to which his mind was attracted by an almost casual incident while he was at Strasburg.

The observations of a manufacturer of chemicals in Germany had long made it known that the impure tartrate of lime of commerce, if contaminated with organic matters, and allowed to remain dissolved in water during warm weather, fermented, and yielded various products. This excited Pasteur's curiosity, and he prepared some pure right-handed tartrate of ammonia,* to which he added some albuminous matter, and placed the liquid in a warm chamber, where it fermented. During the process of fermentation, the previously limpid mixture gradually became turbid, and the turbidity was found to be due to the presence and multiplication of a microscopic fungus, which, obtaining its sustenance in the liquid, acted as a living ferment.

To the paratartrate of ammonia this mode of fermentation was also applied successfully, the same organism appearing, though there was a wide difference between the results of the two fermentations, so far as the products were concerned; and the important fact was established, that the molecular dissymmetry proper to organic matters intervened in a phenomenon of the physiological order, and did so as a modifier of chemical affinity. The little fungus was able to assimilate the right-handed tartrate more readily than the left, though there was no chemical difference between them—only a difference in molecular constitution. Pasteur was, in this way, the first to introduce into physiological consideration the fact of the influence of the molecular dissymmetry of natural organic products, and in demonstrating that the common mould or mildew could live and multiply on a purely mineral soil, such as the phosphates of potash, of magnesia, and an ammoniacal salt of an organic acid. Sowing the seeds of this mould—*Penicillium glaucum*—in a solution of pure paratartrate of ammonia, it was seen that in germination the left-handed acid appeared in proportion as the right-handed disappeared, the only aliment the plant obtained for its growth being the carbon in the tartaric acid.

These remarkable experiments led Pasteur to infer that ferments were always living organisms, what had previously been looked upon as ferments being merely their food. The yeast-plant had been previously discovered by Leuwenhoeck in Hol-

* A salt which turns the plane of polarised light to the right; there is also a left-handed tartrate of ammonia.

land, Schwann in Germany, and Cagniard-Latour in France; but its real function was not known, and the chemists proclaimed fermentation to be a purely chemical process. The experiments made by Gay-Lussac at the commencement of this century, seemed to them to prove that the oxygen of the air was the *primum movens* in the process; and Liebig, in promulgating this theory, stated that "the ferments are all nitrogenous substances—albumen, fibrine, casein; or the liquids which contain them, as milk, blood, urine—in a state of alteration which they undergo in contact with the air."

The oxygen was the prime agent in breaking up the unstable union between the complex molecules of these substances, and causing a disturbance and transformation of their ultimate particles, resulting in the production of new compounds. Berzelius and Mitscherlich, however, explained the phenomena of fermentation in a different way—the process was one of *catalysis*—the ferment took nothing from, nor did it add anything to, the fermentable matter, and was an albuminoid substance possessing a catalytic force which enabled it to act by its mere presence or contact. Dumas, nevertheless, thought that in the budding of the yeast-cells there should be some clue to the phenomenon of fermentation, as Cagniard-Latour had already surmised in studying the development of the yeast-plant during the metamorphosis of sugar in water. But until Pasteur took up the subject, it was not in any way or anywhere an accepted hypothesis that organisation or life had any influence on the process.

Pasteur's translation to Lille gave the stimulus to the train of thought engendered by the strangeness of the phenomena he had witnessed, in regard to the molecular dissymmetry of the two tartaric acids, and the effect of a microscopic organism upon them, for this had thrown a new light upon the mystery of fermentation. The wonderful part played by such a minute organism could not be an isolated fact, but beyond it there must lie some great general law. It was argued that all that lives must die, and all that is dead must be disintegrated, dissolved, or gasified; the elements which are the substratum of life must enter into new cycles of life. If things were otherwise, the matter of organised beings would encumber the surface of the earth, and the law of the perpetuity of life would be compromised by the gradual exhaustion of its materials. One grand phenomenon presides over this vast work — the phenomenon of fermentation. But this is only a word, and it suggests to the mind simply the internal movements which all organised matter manifests spontaneously after death, without the intervention of the hand of man. What is, then, the cause of the processes of fermentation, of putrefaction, and of slow

combustion? How is the disappearance of the dead body, or of the fallen plant, to be accounted for? What is the explanation of the foaming of the must in the vintage-cask? of dough which, left to itself, rises and becomes sour? of milk, which curdles? of blood, which putrefies? of the heap of straw, which becomes manure? of dead leaves and plants buried in the earth, which are transformed into soil?

The attempts to solve the problem were numerous, but the hypotheses of the chemists were generally accepted, and Pasteur, being a chemist, might be supposed to favour one or other of these. Not so, however. The inductive method of study and research was his guiding star, and the experimental method of proving all things, was the touchstone of the verity of his inductions. "It is the glory of God to conceal a thing," said the wise Hebrew monarch; "but the honour of kings," he added, "is to search out a matter." Kings in the realms of Science are for ever searching out the hidden things which it is the glory of the Creator to conceal, and their discovery but adds to the glory of concealment.

Located in the principal town of the Département du Nord, one of the chief industries of which is the production of alcohol from grain and beet-root, Pasteur resolved to devote his attention to the study of fermentation, not only with a view to solving the problems in connection with it, but also to apply the knowledge gained to a useful purpose. He studied the spontaneous fermentation of milk (lactic fermentation), in which a portion of the sugar is transformed into lactic acid; and, as a consequence, he found himself opposed to the opinion of the few observers who, detecting living organisms in certain fermentations, imagined the presence of these was accidental, and instead of being favourable to the process, was really detrimental to it. He constantly found an extremely minute microscopical living organism, of well-defined form, consisting of little rods, constricted in the middle, and multiplying by dividing across (fission), each portion forming another rod, which soon underwent the same process of division, and so generation after generation of rods was quickly produced. Other inquirers had failed to observe this organism in the lactic fermentation, through imperfect manipulation and faulty preparation of the liquid: they having mixed chalk with the milk in order to keep it neutral, and employed various nitrogenous substances—all of which rendered it impossible to distinguish the ferment. Pasteur happily avoided this cause of error by boil-

Fig. 1.—*Bacterium Lactis (the Lactic Ferment).**

* This figure, and those on pp. 56, 57, 61, and 117, are reproduced from Dr. Klein's book entitled 'Micro-organisms and Disease,' by permission of the publishers, Messrs. Macmillan and Co.

ing a little yeast in some water, filtering the liquid, dissolving in this some sugar, and then dropping carefully into it a minute quantity of fermenting milk, to act as the seed of the ferment in the limpid saccharine solution. Next day the pellucid fluid had become turbid, because of the active fermentation which had been commenced, and as the chalk dissolved, a deposit took place which the microscope showed was composed of germinating rods of the organism jnst alluded to—the lactic ferment. In another experiment, he substituted for the yeast-water a clear decoction of nitrogenous matter, but the ferment invariably appeared in the same manner.

In order to effectually silence the partisans of Liebig's theory, and indeed of all chemists, as to the accidental presence of the organised ferment, the cells of which, they asserted, perished during fermentation and formed lactate of ammonia, Pasteur unremittingly laboured to demonstrate the falsity of the theory, and to prove that not only was there no ammonia formed during alcoholic fermentation, but if it were added it disappeared, entering into the formation of the new cells. Two notable characteristic and crucial experiments he made, which finally settled the dispute. One was with regard to the yeast of beer or alcohol, and the other to the lactic ferment. He introduced into a pure solution of sugar a small quantity of a crystalline salt of ammonia, and some phosphates of potash and magnesia; into this mixture, which, it will be observed, was destitute of albuminoid matter, he sowed an imponderable quantity of yeast—the living cells of the lactic fermentation. The cells thus sown germinated and multiplied, the sugar fermented, and the phosphorus, magnesium, and potassium of the salts united with elements of the sugar of milk, and were in the end converted into lactic acid. A second experiment made with the same skill and care yielded the same results, and demolished the theory of Berzelius and Liebig, which had no longer any foundation. The whole process took place between the sugar aud the ferment germ—a living organism—which owed its growth and multiplication to the nutriment it found in the sugar: fermentation, in short, was simply a phenomenon of nutrition, the ferment contriving to grow upon the sugar and the mineral salts, the remaining portions of these combining to form, in fermenting milk, alcohol and lactic acid, and in the saccharine fermentation alcohol and acetic acid.

The results of his experiments, and the conclusions he arrived at from a consideration of them, Pasteur laid before the Academy of Sciences in 1857.

By the light of his discovery of the lactic ferment, Pasteur soon found a new ferment—the butyric, which has its own special fermentation, resulting in the production of butyric acid. This

organism consists of minute rods, separate, or united in chains of two, three, or more, which reproduce themselves by division, and which have the power of movement—gliding in an undulating manner, and breaking themselves off from each other by this motile faculty. They can be grown, like the other ferments, in fluids containing fermentable substances, in which they will multiply to an almost indefinite extent, their increase marking the

Fig. 2.—*Clostridium Butyricum, or Bacillus Butyricus* (*the Butyric Ferment*).

Some of the spindle-shaped forms include an oval spore.

progress of the butyric fermentation. In studying this organism or vibrio, Pasteur came upon a new and altogether startling peculiarity of these ferments—that they can not only multiply freely without air, but that the presence of air deprives them of life, and stops the fermentation to which they give rise. A stream of pure carbonic acid, so deadly to animals, may be assed through the fluid in which they are growing, without affecting them; but if a current of atmospheric air be substituted for the acid for a brief space, the organisms subside motionless to the bottom, and fermentation is at once arrested.

The question as to the way in which the ferments induced the phenomena of fermentation had to be answered, and in attempting it Pasteur was brought nearer to a solution of the mystery. The micro-organisms, like the higher animals, were nourished upon suitable pabulum—living upon a portion of the fermentable matter; but while the animal, for a given weight of nutritive matter ingested, assimilates a certain quantity, the "microbe" (as Sedillot named these minute plants), in consuming some of the matter, decomposes a quantity far in excess of its own weight. The "must," or sweet wort of beer or wine, when placed in vats or barrels to produce these fluids, will undergo fermentation when yeast has been purposely added, or when the ferment-germs have been accidentally introduced; and the vital actions of the germs — multiplication, and increase in weight and volume—go on entirely independently of the free oxygen of the air, or of that in the "must." In the immense vats of breweries, fermentation disengages quantities of carbonic-acid gas, which is so much heavier than the atmosphere, that it rests in a dense layer on the surface of the fluid, and completely excludes the

air. Yet the ferment-cells multiply with extraordinary rapidity, notwithstanding the entire absence of air or free oxygen ; while their activity during this period is exhibited in the enormous difference between their weight, when collected as yeast at the termination of the process, and the weight of the "must" or sugar which has fermented, and been transformed into alcohol, carbonic acid, and some other products. It has been computed that a pound of the ferment will cause the transformation of one hundred and fifty pounds of sugar into alcohol.

Fig. 3.—*Torula or Saccharomyces* (*Yeast Fungus*).

In the lower part of the figure an ascospore and four isolated spores (after Rees) are shown. Magnifying power about 700.

In shallow vessels, Pasteur found that the ferment was even more active than in deep vats, though exposed to the air ; but then much less sugar was decomposed—not more than five or six pounds. It was thus demonstrated that the more free oxygen the ferment consumes, the less does it act as a ferment ; while the more completely its vital functions are carried on independently of air or free oxygen, the greater is its power of transforming or decomposing sugar. Life without air, and the process of fermentation, are correlative incidents ; though it is to be observed that oxygen is essential to the life and growth of the ferment-cell, and when not obtainable from the air, it takes it from the saccharine matter, which contains it ; in doing this it produces alcohol, which is merely sugar *minus* some of its oxygen. This ferment-cell or vibrio, and others of its kind, can only live and multiply without air so long as it receives a sufficient quantity of suitable food ; when this is consumed, it dies, and further transformation of the matter ceases, unless another kind of organism finds access.

These investigations led Pasteur to recognise two classes of microscopic organisms—one which requires air or free oxygen

in order to exist and multiply, and which he named *ærobies;* and another which could live actively in the absence of free oxygen, possessing itself of this essential element by taking it from its combinations in the food supplied to it—this class he designated *anærobies*, and its discovery caused much astonishment.* Dumas, the celebrated chemist, said one day at the Academy of Sciences, in addressing Pasteur in reference to the last-named class: "In these infinitely small organisms you have discovered a third kingdom — the kingdom to which these organisms belong, which, with all the attributes of animal life, do not require air for their existence, and which find the heat that is necessary for them in the chemical decompositions they set up around them."

The potency of the anærobic class to act as ferments, it may be observed, depends upon their capacity to live without air, by breaking down pre-existing compounds, and forming new and simpler ones; this done, they perish, and then the ærobic germs may, in their turn, live upon them, and convert their remains into other compounds.

Carefully conducted experiments demonstrated that fluid organic matters deprived of all microscopic germs, retained free oxygen for any length of time, and remained unchanged; but if living germs were allowed access to such matters when kept in closed vessels, in a few days there was no oxygen, but carbonic acid. So it was proved that, contrary to the notion previously entertained, oxygen has but little influence in promoting decomposition when germs are absent; though when they are present it acts most powerfully.

Putrefaction is simply fermentation, the sole agent in one as in the other being microscopic organisms, the fermentation of sugar being simply the putrefaction of sugar. It had long been known that fungi, or microscopic animalculæ, were present in putrefying organic compounds; but that they were the real agents in effecting putrefaction was not proved, and by such authorities as Liebig was even denied. Here, again, Pasteur showed that the destruction of animal and vegetable matter was a process of slow combustion, brought about by appropriation of oxygen from the air, through the instrumentality of the ærobies, which, in reality, have the faculty of consuming the oxygen, and are the powerful agents in restoring to the atmosphere and the soil the elements of things which have lived. Mildew, mould, and other cell-formations, two thousand of which would not measure a millimetre, carry on the great work of maintaining the equilibrium between life and death—they themselves dying and

* I venture to express my idea that the bearing of this discovery upon the phenomena attending the production of sweet and sour ensilage respectively may be worthy of careful investigation.—Edit.

being preyed upon by others; so that the ferments are fermented by other ferments.

"In the destruction of that which has lived," says M. Valery Radot, in his 'Life of Pasteur,' "all reduces itself to the simultaneous action of these three great natural phenomena—fermentation, putrefaction, and slow combustion. A living organism dies—animal or plant, or the remains of one or the other. It is exposed to the contact of the air. To the life which has quitted it, succeeds life under other forms. In the superficial parts, which the air can reach, the germs of the infinitely small ærobies hatch and multiply themselves. The carbon, the hydrogen, and the nitrogen of the organic matters are transformed by the oxygen of the air, and under the influence of the life of these ærobies, into carbonic acid, vapour of water, and ammonia-gas. As long as organic matter and air are present, these combustions will continue. While these superficial combustions are going on, fermentation and putrefaction are doing their work in the interior of the mass, by the developed germs of the anærobies, which not only do not require oxygen for their life, but which oxygen actually kills. Little by little, at length, by this work of fermentation and slow combustion, the phenomenon is accomplished. Whether in the free atmosphere, or under the earth, which is always more or less impregnated with air—all animal and vegetable matters end by disappearing. To arrest these phenomena, an extremely low temperature is required. It is thus that, in the ice of the Polar regions, antediluvian elephants have been found perfectly intact. The microscopic organisms could not live in so cold a temperature. These facts still further strengthen all the new ideas as to the important part performed by these infinitely small organisms, which are, in fact, the masters of the world. If we could suppress their work, which is always going on, the surface of the globe, encumbered with organic matters, would soon become uninhabitable."

In the results of his researches into the acetic fermentation, Pasteur has not only again shown the uncertainty of mere observation as compared with the reliability of experimentation, especially when such a master institutes decisive experiments that are in conformity with and explain facts, but he has conferred a great benefit upon industries closely allied with agriculture, and has more or less directly benefited agriculture itself. And in these researches he has once more upset the theories of such chemists as Berzelius, Mitscherlich, Liebig, and others, and placed our knowledge of an important industrial process—the production of acetic acid—on a safe and solid basis, by proving that this depends upon the fixation of atmospheric oxygen by a micro-organism.

The manufacture of vinegar is largely carried on at Orleans, being one of the staple industries of that city, and to this Pasteur devoted his attention. When wine becomes sour—as in bottles to which, through faulty corking, air has obtained access—it is noticed that the oxygen which was originally in it has disappeared, and that nitrogen has replaced it; while the alcohol has also vanished, and in its stead is acetic acid or vinegar. The presence of air is necessary for this change, and before Pasteur took up the subject, the ordinary method of manufacturing vinegar was to expose barrels half-full of vinous fluid to the air, and at a certain temperature; the acetic fermentation was set up and carried on, and every week a small quantity of vinegar was drawn from the barrel and an equal amount of new wine added. This was a slow and a somewhat unsatisfactory process, inasmuch as some months elapsed before fermentation was fully established. The notion was that the alcohol in the fermenting wine was changed into vinegar, by the chemical influence of the oxygen in the air, acting in the presence of dead albuminoid matter. But Pasteur proved that this matter had no influence in the change; for though alcohol be mixed with pure water until it is reduced to the strength of wine, and exposed to the air, it will show no trace of vinegar; yet if some wine be put in a bottle, and this be sealed and then heated to about 140° Fahr., the same result will be noted; while if it be not heated it will become sour. More than this, if the bottle which has been subjected to the high temperature, be afterwards opened and the air admitted, the wine sours. In addition to this demonstration, and to still further show that the dead albuminoid matter of the chemists had nothing to do with the conversion of alcohol into acetic acid, Pasteur removed all traces of albuminous substance from wine, and introduced to it a small quantity of phosphates of ammonia, potash, and magnesia; the vessel was then sealed up and laid by for some time. When again examined, the alcohol had become vinegar.

The real cause of the change was the presence of a minute fungus—the *Mycoderma aceti*—known for generations as the "flower of vinegar," which is always seen on the surface of wine undergoing the change, but which Liebig, who knew it, considered a mere coincidence. The formation of vinegar is always preceded by the development, on the surface of the wine, of this very minute plant, which, when magnified, appears as an extremely fine constricted body; its accumulation constitutes sometimes a scarcely perceptible scum, at other times a thin wrinkled film, unctuous to the touch, because of the various fatty matters it contains. It has the singular property of condensing considerable quantities of oxygen, and of fixing this gas upon the alcohol, thereby transforming it into acetic acid. But like the

larger members of the vegetable kingdom, it must have its appropriate aliment, and wine offers this in abundance, in the form of nitrogenous matters and phosphates of magnesia and potash.

To make vinegar from wine, all that is needed is to mix it with one-fourth of its volume of vinegar, and sow on its surface a few seeds of the fungus, which is done by transferring a little of the mycodermic film from a liquid covered with it. If it be summer, or if the room be heated (for it thrives best in the warmth), in at most forty-eight hours the whole liquid is covered by it, and after some days the alcohol has become acetic acid. Pasteur, wishing to give an idea of the prodigious activity and prolificacy of the little organism, stated during a discussion at the Academy of Sciences, that he would undertake in twenty-four hours to cover with it a surface of vinous liquid as large as the hall in which they were assembled, having the previous day sown in it the almost invisible particles of newly-formed

Fig. 4.—*Saccharomyces Mycoderma, or Mycoderma Vini.*

From an artificial cultivation of dilute flourishing material.

d. Branched mycelium. *f α.* Torula stage. *f β.* Mycelial stage.
(After Grawitz.)

Mycoderma aceti. Millions upon millions of the organism spring into existence in twenty-four hours. Nothing is more simple than to obtain it in the first instance, it being one of those so-called "spontaneous" productions which are almost certain to appear on liquids or infusions which contain its necessary food. It is present in the air of towns and buildings, and in wine, vinegar, and other fluids; and if it is desired to procure some of the mycoderma, it is only necessary to place a mixture of wine and vinegar in a warm place, when in a few days there will appear

little greyish patches on the surface, which go on increasing progressively and rapidly. This is the Mycoderma grown from the seeds, or "germs" which the wine or vinegar accidentally contained, or which the air carried,—just as weeds grow in fields from seeds which are brought there by the wind or animals. That the latter may be also instrumental in extending the process of acetic fermentation is beyond doubt, for in vinegar manufactories, and in places where vegetable matter is souring, there are usually seen numbers of little reddish flies which come from we know not where, but which, by means of their feet or probosces, convey the seeds of this cryptogam.

When a bottle containing wine is subjected to a temperature of 120° to 140° Fahr., the wine remains sweet, because the Mycoderma germs in it, and in the air in the bottle, are killed by the heat; but if the bottle be opened, the wine will sour, because new germs gain access. Wine in well-filled bottles, laid flat, does not become acid, because the Mycoderma cannot grow without a sufficient supply of oxygen; for although air penetrates the pores of the cork, yet it is in such minute quantity that the oxidisable constituents of the wine absorb it, without leaving any for the germs in the bottle. But when the bottles are placed upright, the corks become dry, and the air more readily passes through them; so that the germs on the surface of the wine are surrounded by air, multiply, and break up the alcohol into acetic acid.

The Orleans method of manufacturing vinegar, Pasteur determined to improve, according to the discoveries he had made in acetic fermentation. The disadvantages attending the system hitherto were very serious, and have been briefly alluded to, Into large barrels is first introduced a quantity of good vinegar, with about a fiftieth part of wine. Eight days after, some wine is added, and in a week another quantity, until the barrel is half filled. Then vinegar is drawn off to a certain amount, and fresh wine added to replace it, this process being repeated every eight days, the maximum quantity of vinegar obtained every week from one of these casks, or "mothers," as they are called, being a little more than two gallons; but when the casks work badly, which is frequent, this quantity is diminished. It requires three or four months to prepare a "mother," which has to be very regularly fed with fresh wine, or all will be spoiled, and the business must be commenced anew; the manufacture has to go on at all times, whether vinegar be required or not; and the barrels cannot be stirred from their places during the process.

Instead of the "mothers," Pasteur recommended vats placed in a chamber heated to about 76° Fahr., and filled with vinegar and wine, on the surface of which the Mycoderma was sown,

This simple process, founded on the exact knowledge of the cause of acetic fermentation, has been eminently successful. A large manufacturer of Orleans stated, that at the end of a week or ten days all the acetified wine is converted into vinegar, and that from a hundred litres of the former he drew off ninety-five of the latter. After the great rise of the temperature noticed when the vinegar is being formed—due to the combination of the oxygen with the alcohol, that fluid is allowed to cool, is drawn from the vat, barrelled, refined, and is ready for use. The vat being emptied, is cleaned, again charged, the acetified wine sown with the plant, and the same process gone through.

It has long been noticed that vinegar, when kept for some time, becomes turbid and impoverished in a remarkable manner, and finally becomes putrid. Pasteur pointed out the cause of this, and also the remedy. After the alcohol has become changed into acetic acid, the mycoderm still exists, as it can live upon the acid—beginning with the ethereal and aromatic portion, the most valuable—transforming it into carbonic acid and water, and leaving a small quantity of mineral salts and albuminous matter—the decomposed remains of the plant. This neutral organic fluid is a suitable home for moulds and putrefactive organisms, which consequently rapidly grow, the moulds forming a film over the mass beneath, in which anærobic organisms can consume the dead mycoderms; and thus we have putrefaction in the deeper parts, and combustion at the surface. Minute eel-like organisms also appear in vinegar, and rapidly deteriorate it. It is asserted that there is not a barrel of vinegar manufactured on the now obsolete Orleans system which does not contain them in immense numbers, and, astonishing to mention, they were, previous to Pasteur's investigations, actually considered necessary to the production of vinegar. The mischief wrought by these microscopic creatures is owing to their requiring air to live—like the Mycoderma, they are ærobic; and when the vinegar reaches a certain depth, they form a moving stratum in the upper part of the liquid, where they can obtain air. Here, however, they come into competition with the mycoderms for the essential oxygen which they both must have, and there ensues a struggle for existence. If, for some reason, the film of mycoderms is not formed, or its production is delayed, the ever-moving little eels take possession of the surface of the vinegar and absorb all the oxygen; consequently, the mycoderm cannot develop, or it dies. But if acetification is very active, and the plant has occupied the upper strata, the eels are gradually driven away, and take refuge against the moist sides of the vessel, where they compose a thick grey lining, which is all in movement, and where their enemy cannot so seriously injure

them, since they are surrounded with air. Deeper in the fluid they would perish, and they only linger at the sides of the barrel until they get an opportunity to again contend with their vegetable enemy. Pasteur's intervention removed the evil: the vats are thoroughly and frequently cleaned, so that the organisms have no time to do any harm.

Guided by his studies on vinegar, Pasteur has been able to effect great improvements in the manufacture of beer and wine, by which production is cheapened, and the keeping properties of the liquids much enhanced.

These improvements are founded upon the observed injurious effects of the organisms which give rise to the acetic, lactic, and butyric fermentations; and the measures adopted to prevent them are most simple and effective—the process now being known as "Pasteurisation." With regard to beer, he recommended that it should be bottled when fermentation is nearly completed, and the bottles then subjected to a temperature of between 122° and 131° Fahr., so as to destroy all injurious germs. The wort, while cooling, was also to be guarded against all atmospheric germs, and the leaven employed for making it was likewise to be free from them. Wine has its own peculiar micro-organism—the *Mycoderma vini*—which feeds on new wine, but dies as this becomes old. The vinegar ferment cannot live upon new wine, but as soon as the *Mycoderma vini* perishes and decays, the *M. aceti* attacks it and grows rapidly, so that the wine becomes sour. "Flat" wine, and "greasy" wine (peculiar to the white wines of the Loire basin), as well as the "bitterness" of Burgundy wines, are also due to particular microscopical organisms. The ageing of wine mainly depends on its oxidation, the oxygen which was previously mixed in a mechanical manner with it becoming chemically incorporated in it; for new wine, when destitute of air, does not age, and the difficulty in managing wine is to permit a certain amount of air to be present without any deteriorating germs. M. Radot, in alluding to this subject, says:—"In short, according to Pasteur's observations, the deterioration of wines should not in any case be attributed to a natural working of the constituents of the wine, proceeding from a sort of interior spontaneous movement, which would only be affected by variations of temperature or atmospheric pressure; they are, on the contrary, exclusively dependent on microscopic organisms, the germs of which exist in the wine from the moment of the original fermentation which gave it birth. What vast multitudes of germs of every kind must there not be introduced into every vintage-tub! What modifications do we not meet with in the leaves and in the fruit of each individual spoilt vine! How numerous are the varieties of organic

dust to be found on the stems of the bunches, on the surface of the grapes, on the implements of the grape-gatherers! What varieties of moulds and mildews! A vast proportion of these germs are evidently sterilised by the wine, the composition of which, being at the same time acid, alcoholic, and destitute of air, is so little favourable to life. But is it to be wondered at that some of these exterior germs—so numerous, and possessing in a more or less marked degree the anærobic character—should find, at certain moments in the state of the wine, the proper conditions for their existence and multiplication?"

To protect the wines from these injurious organisms, Pasteur demonstrated that it was only necessary to heat them, when bottled, to a temperature of 140° Fahr. for a few moments, in a water-bath. This insures the future soundness of the wine. After having shown the causes which determine the alterations in wine, by introducing a means of practically neutralising them, Pasteur solved one of the greatest economic questions with regard to this industry. By the application of heat, and without injuring their colour or flavour, the limpidity of all wines was guaranteed, while their indefinite preservation was certain if kept in well-closed bottles, or in barrels, even if transported all over the world.

An amusing incident is related in connection with this discovery. Those most concerned in the preservation of wine were at first incredulous as to the heating process not damaging its taste, colour, or limpidness; and Pasteur addressed himself first to wine-merchants and others who were skilled in the detection of alterations in it, with a view to obtain a decisive opinion—for the public had already shown a preference for his heated wine; and at last he organised a large tasting Commission, appointed by the wholesale wine-merchants of Paris. This body, at its first meeting, could not agree as to the supa riority of the heated or unheated wines placed before them, many of them thinking the latter had a better flavour than the former; and Pasteur, fancying that prejudice had much to do in influencing them, intimated that at the next meeting there would be no indication as to which was the heated and the unprepared wine, but their palates should alone distinguish them. On that occasion, he offered them samples taken from the same bottle, and as might be expected, there were preferences for one and for the other, the experts not knowing they were from the same source. The Commission, alluding to this experiment, candidly confessed that the differences between the heated and non-heated wines were imperceptible, if they existed, and that the imagination was not without considerable influence in wine-tasting.

The researches of Pasteur had revealed a world of organisms,

whose minuteness had hitherto either enabled them to escape observation, or to conceal their special function in the economy of nature; and the origin of these wonderful living particles, whose operations are so vast and important in their results, could not but arrest attention. Indeed, the question of spontaneous generation, upon which grave issues in pathology in particular depended, was one which Pasteur was in a manner compelled to take up. It was certainly one that had come down to our own day from hoary antiquity, but it was being debated with unusual warmth while he was successfully unravelling mysterious processes, which he traced to the action of microscopical germs, whose source might be ascribed to a spontaneous or fortuitous combination of elements. Aristotle was of opinion that all damp bodies which become dry, and dry ones which become damp, engender animal life; Virgil thought bees were produced from the putrefied intestines of a young bull; and, much nearer our own time, Van Helmont stated that the smells that rise from marshes produce frogs, leeches, slugs, &c.,—nay, he had even the temerity to assert that mice could be produced by keeping a dirty shirt in the mouth of a vessel containing a little corn, which is transformed into these creatures after a number of days—he had witnessed it! and scorpions could be developed from crushed herbs placed in a hole in a brick! In the last century, Needham maintained the doctrine of spontaneous generation, but Spallanzani opposed it; Redi, an Italian naturalist, showed that maggots are not spontaneously developed in meat, but come from the eggs of flies. The introduction of the microscope was seized upon by the "Spontaneists" to support their notions, as in no way could the appearance of animalculæ in previously barren fluids be accounted for. Mistakes might have been made with regard to the origin of mice and maggots, but it could not be so in the case of microscopic living things. How, except by spontaneous generation, could the presence and rapid multiplication of these in decomposing animal or vegetable substances be explained? Buffon even lent himself to this doctrine, and devised a system in explanation of the hypothesis. In 1858, Pouchet, Director of the Museum of Natural History at Rouen, declared before the Academy of Sciences that he had succeeded in demonstrating, in an absolutely certain manner, the existence of certain microscopic living organisms which had been developed without pre-existing germs.

In a series of ingenious and ably-conducted experiments, Pasteur demolished, one after another, the arguments of Pouchet and the other heterogenists, by convincing demonstrations. "There is not one circumstance known at the present day," he

exclaimed in a discourse at the Sorbonne, "which justifies the assertion that microscopic organisms come into the world without germs, or without parents like themselves. Those who maintain the contrary have been the dupes of illusions and of badly conducted experiments, tainted with errors which they knew not how to perceive or avoid. Spontaneous generation is a chimera."

And Flourens, permanent Secretary of the Academy, hitherto neutral in the discussion, said on the same occasion: "As long as my opinion was not formed I had nothing to say; now it *is* formed, I can speak. The experiments are decisive. If spontaneous generation be a fact, what is necessary for the production of animalculæ? Air and putrescible liquids. Now Pasteur puts together air and putrescible liquids, and nothing is produced. Spontaneous generation, then, has no existence. Those who still doubt have failed to grasp the question." Subsequently, in England, Dr. Bastian became the strenuous advocate of spontaneous generation, but the crucial experiments and absolutely convincing demonstrations of Professor Tyndall, finally abolished the erroneous ideas which had prevailed for so many centuries.

As is well known, the production of silk forms the principal industry of several Departments in the South of France, and the rearing of silkworms occupies the time and attention of great numbers of people—chiefly agriculturists. Previous to 1849, this industry had been particularly flourishing; but in that year, after an exceptionally good silk-harvest, and without any appreciable cause, several of the large establishments were visited by disease among the worms, and this in the course of time assumed the proportions of a plague among the silkworm-nurseries, until at last the silk-husbandry of France was on the verge of ruin. The symptoms of the disease were numerous and variable, and sometimes the worms died early, at other times not before the first, second, or third moulting; oftentimes the eggs were sterile. Instead of becoming white, the worms retained a rusty tint; they did not eat; spots appeared on their bodies like black bruises, which were scattered over the head, rings, and feet. Every batch or brood attacked perished. Fresh eggs were imported from abroad, and at first these hatched well—so much so, that the year 1853, when a large quantity of these foreign worms were reared, was estimated as one of the most productive of the century, 130,000,000 francs being derived as revenue from the cocoons. But the following year the eggs from these worms were found to be no better than the French eggs—they were also infected. To add to the misfortune, the malady extended to Spain and Italy, then to Greece and Turkey, until, in 1864,

all the cultivations from every part of Europe were either diseased or suspected of being so; and throughout the extreme East, Japan only was exempt. The plague had followed the trade in silkworm eggs, just as cattle diseases have followed the trade in cattle.

In 1865, the weight of cocoons had fallen so low, that the French revenue sustained a loss of 100,000,000 francs, and the silk-cultivating Departments were in despair. Agricultural and scientific societies, municipal bodies and governments, were all seriously engaged in attempting to discover the cause and a remedy. And there was no lack of hypotheses, suggestions, and cures; while scores of pamphlets upon the malady were published every year, and experiments were undertaken to elucidate the mysterious scourge, and limit its ravages.

The disease was known as "pébrine," owing to the peppered appearance of the skin of diseased worms.

In 1865, in response to a petition signed by 3600 mayors, municipal councillors, and capitalists of the severely-visited Departments, the French Government appointed a Commission to investigate the malady, and Dumas was selected as its Chairman or reporter, because of his great scientific reputation and his personal interest in one of the afflicted Departments. While preparing his report, it occurred to him that Pasteur was the man best fitted to carry out investigations as to the measures required to combat the plague. But Pasteur at first declined to undertake such a heavy task, inasmuch as his success in the enquiry into organised ferments, in their relation to the manufacture of vinegar and diseases of wines, had opened prospects of a prosperous career—in fact, it was at the moment when, disposing of the vexed question of spontaneous generation, the "infinitely little" had become to him, and to science, the "infinitely great." He saw living ferments everywhere, either as the active agents in decomposition or in producing contagious disorders. To forsake a course which he had so fruitfully pursued and made his own, with all its prospective advantages, and to enter upon another which was novel to him, and the determination of which might be the reverse of satisfactory, appeared to be too much of a sacrifice. Dumas appealed to his friendship and his patriotism. "But consider," said Pasteur, "that I have never handled a silkworm." "So much the better," replied Dumas. "If you know nothing about the subject, you will have no other ideas than those which you will derive from your own observations."

Being at length persuaded to undertake the duty, he had to decide upon the method to be adopted in his endeavour to discharge it. For seventeen years hypotheses and observations with

regard to the disease had been accumulating, and facts and opinions were only too abundant to be made available to any extent in this direction. But among the memoirs which the calamity had called forth, one of the best was that presented to the Academy of Sciences by M. Quatrefages, and a paragraph in it had especially attracted the attention of Pasteur. This had reference to the discovery by some Italian naturalists of microscopical bodies—vibratory corpuscles—in the silkworms and moths, which Lebert affirmed could always be detected in these when diseased, and which Osimo, of Padua, had also perceived in silkworms' eggs. Another Italian, Vittadini, had even proposed the examination of the eggs by means of the microscope, in order to obtain sound ones. The mention of this in the 'Memoir' in question was merely casual, being considered of doubtful importance; but it fixed Pasteur's mind on the necessity for the employment of the microscope—an instrument which had already rendered him such immense service in his experiments on ferments, that its employment again as a means of research possessed a strong fascination for him.

He started on June 6, 1865, for Alais, where the plague raged most disastrously, determined not to return until he had mastered everything of importance connected with it. In a few hours after his arrival he had discovered, and was able to show, the corpuscles in certain worms, and after some days' examination satisfied himself that these living disease-corpuscles were numerous in the chrysalides, while there was not one of the moths but had them in profusion. In the eggs and the worms the germs existed in an imperceptible condition, and the only infallible method of procuring healthy eggs, Pasteur insisted, was by having recourse to moths free from the corpuscles. This method he had proved by experiment to be correct, but critics would not accept his statements, and he pursued his enquiry with that scrupulous care, intelligence, and pertinacity so characteristic of him, returning annually to Alais for several months during five years, to complete his work. The contagious nature of the disease—which was doubted by many, and the manner in which the contagion was conveyed—about which there existed several opinions among those who believed in its communicability, were the first points he determined. To ascertain its contagiousness, as well as the mode of infection, he took some healthy worms free from corpuscles, and fed them with diseased worms, which were pounded and smeared over the mulberry-leaves they ate; and after a certain time the corpuscles, which had already shown themselves in the walls of the intestines, began to appear in the other organs, with those red spots on the heads and the rings of the bodies, which had caused the disease to be named "pébrine" by

the peasants. Digestion in the worms was impeded because of the presence of these organisms in their intestines, and they were generally unhealthy; while those which spun their cocoons produced chrysalides which were little better than pulp. It was thus shown that the corpuscles, gaining access with the food into the intestinal canal, infested all the body in a few days; the spots on the skin were only the effect of the disease, being somewhat allied to the eruption of measles in mankind. Another lot of healthy worms fed on untainted mulberry-leaves at the same time, remain perfectly free from the malady. This and similar experiments were repeated, and varied times without number, so as to prove the correctness of the conclusions at which he had arrived, and exactly accounted for what took place in the silkworm establishments. From the malady which attacked the worms at their birth, destroying a whole cultivation, down to the invisible disease that lurked in the cocoon, all was explained. But as in these establishments worms were never directly affected through food purposely soiled by diseased worms, it was asked how they became diseased. Pasteur pointed out that, in a cultivation of silkworms in which there were diseased ones, these were continually fouling the food by their excreta, which the microscope showed to be swarming with these corpuscles. This cause of natural contagion was rendered all the more effective, because the worms, by the weight of their bodies, pressed the excreta against the leaves in crawling over them. By mixing these excretions with water, and painting mulberry-leaves with them, a single leaf off the latter enabled Pasteur to infect as many worms as he liked. Another natural and direct cause of infection was inoculation by the hooks on the feet of the worms, which, in crawling over each other, wounded their skins; and if these hooks were soiled by infected excretions, or by the corpuscles immediately beneath the skin, infection was certain. Infection at a distance through the medium of the air and the dust it carries, was an equally well-ascertained fact. It was sufficient to sweep the breeding-houses, or shake the hurdles on which the silkworms were reared, to raise the dust of dead worms and corpusculous excretions, which falling over the hurdles of healthy worms, after a time caused the disease to appear among them. When quite healthy worms were placed in a breeding nursery at a considerable distance from unhealthy worms, they, in their turn, became infected. It was observed that in some factories healthy worms were reared, in which the year before nearly all had perished. Pasteur explained this by showing that dust can only act as an infective matter when it is fresh; corpusculous matter loses its virulence when thoroughly dried, and a few weeks are sufficient to bring about such a result.

The corpuscles contained in the eggs alone caused the transmission of the disease to future generations; and thus it was both contagious and hereditary.

Pasteur had demonstrated that moths free from corpuscles produced eggs also free from them; and also that eggs hatched at a distance from infected eggs produced healthy worms, chrysalides, and moths. It was easy, therefore, to multiply cultivations free from the disease; and to secure the production of silkworms and silk, to guarantee that the eggs were sound, Pasteur recommended that a moth should be crushed up in a little water, which is then examined with a microscope to ascertain if any corpuscles are present.

In his investigations, Pasteur soon recognised that there was another disease at work, no less destructive, though less widely spread, than the so-called *pébrine*. During his experiments, in a cultivation of say a hundred worms, a large number, as many sometimes as twenty, would be picked up daily; these turned black and putrefied within a few hours, being soft, flabby, and hollow; they were free from the *pébrine* spots, and no corpuscles could be found in them, while these organisms were also absent from the chrysalides and the moths of the few worms which were able to spin their cocoons. Pasteur was certain that he had to deal with a distinct disease, and that this was one known to French writers upon silkworms by the name of *flacherie*, or *morts-flats*. The cultivations most seriously affected by the malady came from eggs yielded by moths entirely free from corpuscles. Microscopical examination settled the question. If, at the period of rearing of silkworms, which happens when the mean temperature of the air is high, some mulberry-leaves are crushed with a little water in a mortar, and the liquid allowed to stand for twenty-four hours, it will be found to be teeming with microscopic organisms—some motionless, resembling little rods or spores joined like strings of beads; others, flexible and moving about in a sinuous manner, like the vibrions found in nearly all decomposing organic infusions. The germs of these organisms were on the surface of the leaves before they were pounded, in the water, or on the pestle and mortar. So long as the intestines of the worms were healthy, the germs were either digested or expelled without causing damage; but whenever digestion was impaired, which, with such a ravenous creature, and rapidly growing, might be frequent, then the disease appeared. "Every *ver flat* (flattened instead of round) is one which digests badly, and, conversely, every worm which digests badly is doomed to perish of *flacherie*, or to furnish a chrysalis and a moth, the life of which,

through the injury produced by organised ferments, is not normally perfected," said Pasteur.

The vitality of the germs of *flacherie* was much greater than those of *pébrine*, which, if dried, perished within a year; whereas the former retained their life for several years. The dust of a silkworm nursery infected by *flacherie* appeared under the microscope largely made up of cysts or spores of vibrios, which would remain latent until wet or damp roused them into activity. Falling on the leaves which serve as food, they are carried into the intestines of the silkworms, grow and multiply there, and cause illness, unless the worms are vigorous, when they may be digested with the food. It is a struggle for life between the silkworms and the vibrios, in which the former are unfrequently victorious.

Accidental *flacherie* could be prevented by hygienic precautions; but when hereditary, *i.e.* developed through diminished vitality of eggs or embryo, Pasteur resorted to the microscope, by which information as to the health of the worms, chrysalides, and moths for egg production, could be obtained.

After the most patient study of this compound disease of silkworms, Pasteur had arrived at such knowledge of its causes, course, and different manifestations, that he could at will produce either form— *pébrine* or *flacherie*, and could so regulate its intensity as to have it appear, experimentally, on a given day, almost at a given hour. But a remedy for the evil was not so readily devised. One form, *flacherie*, was capable of comparatively easy control, by care in feeding, and keeping the surroundings in a proper state.

With the other form—*pébrine*—by far the most serious, preventive measures were not so soon arrived at; but through a series of observations, as simple as they were ingenious, Pasteur concluded that the cause was to be combated in the eggs, and, acting on this view, he ultimately triumphed over the scourge.

The process now most successfully pursued in the silk-growing districts, for avoiding the plague, is described as follows:—

The cocoons are finished, and the appearance of the moths alone is waited for. They arrive, and they pair. Then begins the work of the cultivator, who is careful about the production of the eggs. He separates the couples at the end of the day, laying each female moth by itself on a little linen cloth suspended horizontally. The females lay their eggs. After the laying, the attendant takes each female in turn, and secures her by a pin passed through the wings to a folded corner of the little

cloth, where are grouped some hundreds of eggs which she has laid. The male moth might be pinned to another corner of the cloth, but the examination of this creature is unnecessary, as he does not convey the disease. The female moth, after having been thoroughly dried by free contact with the air, is examined at leisure—as during the winter or autumn. Nothing is easier than to discover whether there are any *pébrine* corpuscles in its dead body. The moth is crushed in a mortar and mixed with a little water; then a drop of this is examined by means of a microscope. If corpuscles be found, the bit of cloth corresponding to the examined moth is known, and burnt with all the eggs it contains.

As has been mentioned, this protective or preservative measure has been found capable of unlimited application, and is universally adopted. In the Basses-Alps, in Ardèche, in Gard, in the Drôme, and in other parts, may be met with everywhere, during the cultivation season, establishments where hundreds of women and young girls are occupied, with a remarkable division of labour and under the strictest supervision of skilful overseers, in pounding the moths, in examining them microscopically, and in sorting and classifying the little cloths upon which the eggs are deposited.

When he had completely fulfilled his mission in 1869, and had restored to France what might have been looked upon as a lost industry,—through the fatigue and intense application to which he had subjected himself,—he was attacked with paralysis of the entire left side of the body, which left him prostrate for some time, and from which he has not yet entirely recovered. His proposed method of combating the silkworm-disease was not accepted without serious doubts and opposition,—for throughout his career he has had to contend continually with determined opponents, who have endeavoured, notwithstanding his lucid demonstrations, to ignore or minimise the grand results he has achieved. In 1869, while still suffering from the severe effects of his unfortunate illness, he, impelled by these doubts and contradictions, had himself carried to Alais, where he struggled, by giving directions from his arm-chair, through a repetition of his experiments, and succeeded in once more proving the certainty and simplicity of his method. The French Government, nevertheless, influenced by his detractors, still hesitated to adopt his process of culture; but the late Emperor interposed, and offered Pasteur the Villa Vicentia, near Trieste, belonging to the Prince Imperial, as a suitable locality for affording a convincing test of the plan, as for ten years the silk-harvest at that place had not sufficed to pay the cost of the eggs. Transported across France and Italy with difficulty, because

of his helplessness, he succeeded in reaching the Imperial Villa, where his skill was rewarded with marvellous success; for in a short time the sale of the cocoons realised a net profit of twenty-six millions of francs. On this result being made known, the Emperor nominated him a Senator of France in July 1870; but before the nomination was gazetted in the official journal, the war with Germany interfered, and Pasteur returned to France to share in the misfortunes and mortifications of his country during that eventful period.

When the war was over, he commenced his studies on the preservation of beer, to which allusion has been already made. The results of these studies were so beneficial that they were universally recognised; and as an instance of the estimation in which they were held beyond France, it may be mentioned that a celebrated scientist of Copenhagen, Jacobsen, had a bust of Pasteur placed in the *salle d'honneur* of his celebrated laboratory. On the conclusion of the report which he made on these studies, Pasteur alluded to the principles upon which, for twenty years, he had pursued his labours—principles the application and advantages of which seemed to him without limit; and, firm in his conviction, he prophetically wrote, "the etiology (cause) of contagious diseases is on the eve of having unexpected light thrown upon it."

Two hundred years before Pasteur had achieved his well-deserved fame, England could boast of three men whose names yet stand pre-eminent in natural science—Newton, Hooke, and Boyle. Boyle was born in the year in which the great Bacon died, and he was the earliest, though perhaps not the most distinguished, of those who practically applied the precepts set forth in the 'Novum Organum' of the Imperial Verulam, and is therefore the patriarch of experimental science, at least in England—a science of which Pasteur is now one of the chief exponents. Boyle's genius as a physicist led him into many notable discoveries and surmises, and one of the latter is most memorable in relation to the subject which now occupies our attention, forecasting, as it did, the revelations effected by Pasteur in the direction indicated by him. "He that thoroughly understands the nature of ferments and fermentation," wrote Boyle, who had devoted much time, amid his multifarious studies, to this question of fermentation, "shall probably be much better able than he that ignores them, to give a fair account of divers phenomena of certain diseases (as well fever as others), which will perhaps be never properly understood without an insight into the doctrine of fermentation."

The mention of contagious diseases recalls sad memories of agricultural misfortunes in the United Kingdom, for nearly half

a century—of desolating plagues among all kinds of stock, for years unchecked and uncontrolled, then encountered with harassing and sterile legislative measures, until property of the value of many millions of pounds was lost, and agriculture was greatly crippled. The admission and the continuation of these maladies amongst our flocks and herds were due, at first, to the little that was known of their history or nature; and in later years, when their communicability was conclusively ascertained, their widespread ravages were unchecked, partly through indifference, and partly through mistaken economical notions.

It was not until the true nature of fermentation was elucidated, thanks to Pasteur, that the cause of communicable disorders in man and beast was satisfactorily and firmly established. The doctrine of a living infecting agent—a *contagium vivum*—in these maladies had certainly been accepted by physicians for a very long time, though it was based only on hypothesis; and even long before then, again, it was imagined, in explanation of the phenomena of contagion, that in transmissible maladies there was given off an imponderable and subtle matter—an *aura contagionis*—which was the active principle operating in their production; this unknown *something* could originate the disorders in healthy bodies into which it had penetrated from those already suffering from its effects. Then the chemical notion of the cause of fermentation, originated mainly by Liebig, was applied to these diseases, which were, and are now, consequently designated *zymotic* (from the Greek word for leaven). Like the ferments, the poisons and disease processes were supposed to be the results of atomic disturbance peculiar to substances in course of molecular change, and capable of communicating themselves to the various constituents of the living body. As with fermentation, so with contagious diseases; the part played by the microscopic organisms, as shown by Pasteur, revolutionised our ideas and revived the doctrine of living contagia. And Chauveau, the eminent director of the Lyons Veterinary School, was the first to demonstrate that the virus of a contagious disease (sheep-pox) was particulate, while putrefaction in wounds was due to atmospheric germs. In 1862, also, Pasteur had announced in his memoir on Spontaneous Generation, and in opposition to the views then entertained, that when urine becomes ammoniacal the alteration is caused by a microscopical fungus, and not by mucus or pus; at a later period he established the fact, that in affections of the bladder ammoniacal urine was always associated with the presence of this fungus, to the development of which borax, he discovered, was antagonistic. The application of this discovery in the treatment of urinary disorders has been most beneficial; as the dangerous fermentation of urine in the

bladder is prevented by injecting a solution of borax, which causes no pain, into that organ. About this time, also, Lister, then a professor of surgery in Scotland, moved thereto by the researches of Pasteur, began his investigations into antiseptic measures in surgical operations, which he has since perfected to such an extent, that "Listerism" in the treatment of wounds is regarded throughout the civilised world as one of the greatest improvements in modern surgery: rendering the healing of formidable injuries more rapid and certain, and enabling the surgeon to boldly and successfully undertake operations which previously he would not have dared to venture upon, or which were in the great majority of cases fatal. Lister's method simply consists in excluding putrefactive and other germs from wounds, as well as from naturally closed cavities of the body which may have to be opened for the cure of disease.

Pasteur was naturally reluctant to enter upon the study of contagious diseases, though, from his success in elucidating the causes of fermentation and the silkworm disease, he hoped to gain, and indeed felt certain of arriving at, an exact knowledge of their origin. "I am neither doctor nor surgeon," he repeated, when urged to undertake researches into the transmissible disorders of men and animals. But at length he was induced to begin, and he selected for his study one of the most widespread and fatal of animal diseases—that which is known to scientists as Anthrax, and to agriculturists and others in this country by various names, some of them local: such as Splenic Apoplexy, Splenic Fever, &c.; and in France as "Charbon," and in Germany as "Milzbrand."

This anthrax destroys wild as well as domesticated animals, herbivorous creatures and rodents being most susceptible, and it prevails, in one or more of its diversified forms, over probably the entire surface of the globe. It sometimes decimates the reindeer herds in the Polar regions, and is only too well known in the tropics and in temperate latitudes. The carefully-tended ruminants of the most highly civilised countries, suffer equally with the wandering herds and flocks of the Tartar Steppes; and the scourge is as much dreaded by the Finns and Lapps, as it is by the Mexicans, the Arabs, the Annamites, or the South African and Australian colonists. It has been carefully described by travellers, veterinary surgeons, and others, as they have observed it in Siberia, Lapland, Russia, Central Asia, and Asia Minor, China, Cochin-China, the East and West Indies, Peru, Paraguay, Brazil, Mexico, North America, Australia, North and South Africa, and Egypt. Europe appears to be specially visited by it, and some parts suffer most seriously from its ravages. The books and papers which have been published

with regard to outbreaks of the disease, and its nature, characteristics, and the damage it inflicts, are innumerable. Countries with extensive marshes, low-lying valleys, or a tenacious subsoil, are those most affected. Thus it happens that there are regions notorious for the prevalence of anthrax—as the marshes of Sologne, Dombes and Bresse, Brie and Beauce, in France; and certain parts of Germany, Hungary, and Poland. It is enzoötic in the half-submerged valleys and the maritime coasts of Catalonia, and also in the Romagna and other marshy districts of Italy; while it is epizoötic, and extends itself to people, in the swampy regions of Esthonia, Livonia, Courland, and, above all, in Siberia, where sometimes, in order to suppress the ravages of the terrible "Jaswa," as it is termed, the aid of the military authorities is called for, and battalions of soldiers are sent to bury or burn the thousands of infected carcasses of animals which have died from it. And elevated countries are not exempted from it, for in the Bavarian Alps, for instance, it exacts an annual tribute of victims.

The antiquity of anthrax is as great as its geographical extension is wide. It was one of the plagues with which the Egyptians were punished in the time of Moses, when there was a breaking forth of *blains* upon man, and upon beast, throughout all the land of Egypt: upon the horses, upon the asses, upon the camels, upon the oxen, and upon the sheep. Virgil, in his 'Georgics,' has depicted its deadliness and its contagiousness with the greatest accuracy, pointing out the dangers of the tainted fleeces of diseased sheep to mankind, as if he were describing the cause of what is now known as the "woolsorters' disease"—anthrax conveyed to man by infected wool, and far from uncommon among people employed in woollen factories in this country. It frequently occurs in the histories of the Early and Middle Ages, as a devastating pestilence among animals, and through them as a plague of mankind. Our oldest Anglo-Saxon manuscripts contain many fantastic recipes, charms, and incantations, for the prevention or cure of the "blacon blegene" (black blain), and the relief of the "elfshot" creatures. From these up to our own times, anthrax has attracted more and more attention; even in this century, it has spread in some of its outbreaks over the whole of Europe, from Siberia to France.

The losses inflicted by anthrax are appalling. Some idea of their extent may be derived from the fact, that in one district of France alone, Beauce, it kills about 178,000 sheep, which (at only thirty francs a head) are worth 5,340,000 francs, or 213,600*l.* In 1842, when sheep were much less valuable than now, the loss in the same district was estimated at 7,080,000

francs. The disease also prevails among sheep in Brie, Champagne, Berri, Poitou, Auvergne, Dauphiné, and Bourgogne. In the arrondissement of Chartres, 17,800 perish from it every year; in Beauce, 20 per cent. of the sheep die, a loss of seven or eight millions of francs annually. It is estimated that sheep to the value of twenty millions of francs are lost annually in France. Cattle, horses, and other creatures, suffer also severely. In Russia the losses are enormous, especially among the horses and cattle. In 1837, in one district alone, 1900 died of anthrax; and in 1857, for the Russian Empire, it was reported that 100,000 horses had perished. In 1860, 13,104 cattle, out of 18,883 attacked with the "Jaswa," succumbed; and from the official report for 1864, it appears that in the five governments of St. Petersburg, Novgorod, Olonetz, Tver, and Jaroslav, 10,000 animals died, most of them horses, few cattle, and still fewer sheep; while 1000 persons were infected and perished. From the 15th of January to the 27th of March, 1865, 47,000 cattle, 2543 horses, and 57,844 other domesticated animals, were lost in the governments of Minsk, Vitepsk, and Mohilev; and in the government of Tobolsk, in June and July, 1874, there perished from the "Siberian plague" (as anthrax is sometimes designated) 4735 horses, 516 cattle, 1030 sheep, 52 pigs, 15 goats, and 106 human beings. In other European countries it is very prevalent and deadly, and in our own islands it causes heavy losses at times. In India it is witnessed in all animals, and as "Loodiana disease" it is well known as a fatal scourge among military horses. In South Africa, as "Horse-sickness," it is most destructive, particularly in low-lying damp regions, at a certain season of the year, when it kills nearly all the horses after only a few hours' illness.

The real cause of anthrax was, until recently, involved in the greatest obscurity, and many influences were invoked to account for its appearance. But it may be noted that several Continental veterinarians, as Numann, Marchant, Gerlach, Plasse, and Delafond, were of opinion that it was of cryptogamic origin—the minute fungi finding entrance into the body with damaged grain or forage. The contagious nature of the disease had been known from the remotest antiquity.

In 1844, Delafond, then a teacher at the Alfort Veterinary School, was sent by the French Government to investigate the disease as it appears among sheep—known as the *maladie du sang*—in the districts where it was causing the heaviest losses. On examining the blood of diseased sheep microscopically, he observed peculiar rod-shaped bodies, but did not attach any importance to them. This fact has been lost sight of by nearly all recent writers on the malady. Pollender, a

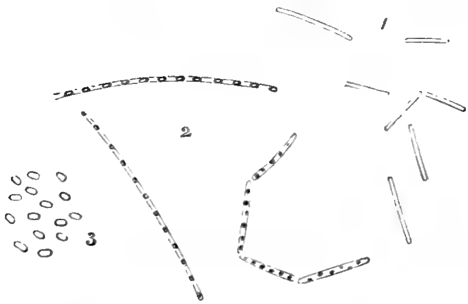
German, observed these bodies in 1849, Davaine and Rayer in 1850; and Brauell, of the Dorpat Veterinary School, in 1856, also noticed them. But these likewise did not realise the significance of their presence in the blood of anthrax-stricken animals.

It was not until 1863, that Davaine, having had his attention once more drawn to these organisms in the blood, by Pasteur's discovery of the butyric ferment, was led to examine whether they, if introduced into the blood of an animal, would also play the part of a ferment; as, if so, this would explain the rapid infection of the blood in an animal which had received into its veins, accidentally or experimentally, a certain quantity of this ferment. Inoculating sheep and rabbits with blood taken from a diseased sheep a few hours after death, he constantly found the organisms, which he named *Bacteria;* though when inoculated with blood from the infected animal before these rods were visible, and while it yet appeared in health, no effect was produced. "In the present state of science," wrote Davaine at this time, "no one would think about going beyond these corpuscles to seek for the agent of contagion. This agent is visible, palpable; it is an organised being endowed with life, which is developed and propagated in the same manner as other living things. By its presence and its rapid multiplication in the blood, it undoubtedly produces modifications in that fluid, after the manner of ferments, which speedily destroy the infected animal." This was the first direct evidence that a contagious disease is produced by a microscopic organism, and the discovery converted into a fact what was before only a hypothesis.

Davaine's announcement was not received without doubt and hesitation by some, and two experimentalists—MM. Jaillard and Deplat—were unsuccessful in arriving at the same results by experiment, and consequently sought to refute his conclusion. Paul Bert also opposed his view, and corroborated that of Jaillard and Deplat. "I can," he said, "destroy the bacteria in a drop of blood by means of compressed oxygen, inoculate with it, and reproduce the disease and cause death without any appearance of bacteria. Therefore they are neither the cause nor the necessary effect of splenic fever. It is due to a virus." And so the controversy went on.

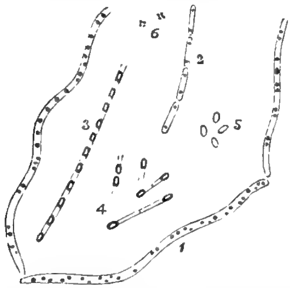
At this time, a young physician in Germany, Dr. Koch, began to study the anthrax *bacilli* or *bacteria*, as they have been indifferently termed; though Cohn, another German investigator, was also at work in defining their morphology. Koch traced the life-history of the *Bacillus anthracis*, as it is now designated, and showed how widely it was distributed throughout the blood and organs, and especially the spleen of animals which

Fig. 5.—*Bacillus Anthracis.*



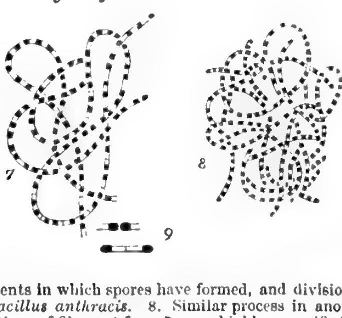
1. Rods of *Bacillus anthracis* as seen in the blood. 2. Portions of rods under cultivation. 3. Groups of spores. 1 and 2 magnified about 500 diameters. 3 about 700 diameters.

Fig. 6.—*Stages of Bacillus Anthracis under Cultivation.*



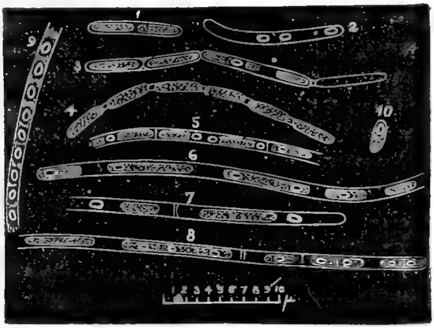
1. Wavy filament, showing commencing lateral formation of spores, as granular dots. 2. Another part of same cultivation, filament dividing, each segment having a terminal dot. 3. Filament in which spores have formed at nearly regular intervals. 4. Portions of filament with spores after division. 5. Isolated spores. 6. Sporules formed by division of spores.

Fig. 7.—*Further Stages of Bacillus Anthracis under Cultivation.*



7. Part of convoluted filaments in which spores have formed, and division is commencing in parts, from cultivation of *Bacillus anthracis*. 8. Similar process in another *Bacillus* not connected with anthrax. 9. Portions of filament from 7 more highly magnified.

Fig. 8.—*Bacillus Anthracis, magnified* 1500 *diameters.*



1. A short rod (8 μ long) in which the protoplasmic contents have divided previous to fission of the rod. 2. A clear rod containing only spores. 3. A jointed filament composed of three segments, in one of which fission is commencing, in another a spore has formed, whilst another is empty. 4. Part of filament composed of short homogeneous rods united by a narrower sheath. 5, 6, 7. Parts of long filaments showing various arrangements of the protoplasm and spores. 8. From another filament in which spore formation is proceeding more regularly. Commencing fission is seen at some parts of the filament. 9. Part of filament completely filled with regularly arranged spores. 10. From another cultivation, showing sporule germinating into a short rod.

had died from anthrax; after many attempts he succeeded in growing, or "cultivating," the fungus artificially, and watching its development under the microscope: noting that the rods, like those of the butyric ferment, multiply by division, grow into long straight or twisted filaments, in which, in the course of time, if air is allowed free access, very minute oval spores are seen; then the filaments swell and burst, and the spores are set free. These spores, if introduced into the blood of an animal, or cultivated artificially, grow again into the characteristic bacilli, which eventually become the long filaments that form spores. Such is the life-cycle of this deadly microbe, which multiplies so rapidly that the spores have been seen to germinate in three or four hours; and rodents—such as rabbits, guinea-pigs, or mice—when inoculated with the blood of an animal dead of anthrax, or with the bacilli or spores of an artificial culture, perish usually in from twenty-four to forty-eight hours. The blood, which is dark-coloured, always contains these bacilli, as does the spleen, which is greatly enlarged, sometimes immensely so, and soft, like a bag of water; the urine, as well as the exudations thrown out during the life of the animals, likewise contains these bodies.

Pasteur possibly did not know of Koch's admirable researches, which were published in 1876; neither, probably, did the other disputants in France, for it was in that year that Bert gave an adverse opinion to that of Davaine. However this may be, Pasteur determined to settle the question as to whether

Davaine or his opponents were in the right: and he adopted in his investigation the methods which had led him to such splendid results in his previous studies. He resolved to isolate the organism from infected blood, cultivate it, as Koch had done, in artificial media, and then to test its action upon animals. In this investigation he was assisted by M. Joubert, as, owing to his paralysis, he could not carry it on by himself.

In 1877, he reported to the Academy of Sciences that the bacilli were the only agents in producing anthrax. A little drop of splenic-fever blood sown in urine or in yeast-water, previously "sterilised" (rendered imputrescible by contact with air free from germs), in a few hours produces myriads of them; a drop of this first cultivation sown in a similar manner and with the same precautions, proves as fertile; and this process being repeated for ten or twenty times, it may be taken for certain that all the substances which the first drop of blood might have carried with it, have been completely got rid of. Yet Pasteur found that if a very small quantity of the final cultivation were injected beneath the skin of a rabbit or a sheep, it killed them in two or three days with all the symptoms of the natural disease. In order to satisfy himself and others that there was nothing else than the bacillus at work in producing this effect, he had his cultivation-fluids kept at an absolutely uniform temperature, which allowed the organisms to be deposited at the bottom of the tubes. When he inoculated with the clear upper fluid, or the deposit—the bacilli—he found that the latter alone caused disease and death.

But it was necessary to explain the discrepancy between the results obtained by himself and Davaine, and those of Jaillard and Deplat. These latter had speedily killed rabbits with blood from a cow that had died of splenic fever, and their blood was also so virulent as to kill others, and yet no bacilli could be found in it; while Bert maintained that he had destroyed the bacilli by compressed oxygen, and still the blood retained its virulence. It might be surmised that there were two kinds of destructive agents operating in this blood, and Pasteur had the good fortune to demonstrate that this was actually the case. Some years previously he had ascertained that in none of the tissues or fluids of the body, except in the intestinal canal, are there any germs; that canal alone contains them, as they readily find access to it along with the food and water, and its temperature is favourable to their development. In the commencing portions of the intestine, in which there is air, ærobic microbes can exist; but toward the terminal divisions oxygen is absent, and only anærobic microbes can live. During life the latter can do no harm, as the vitality of the

lining membrane of the intestines prevents their passage through it; but after death this resistance ceases, and the anærobic bodies then begin to exercise their decomposing influence, and carry on the process of putrefaction—penetrating into the tissues and the blood as soon as that has lost its oxygen. In splenic fever, the blood is deprived of much of its oxygen during the course of the disease, so that, after death, decomposition is very rapid. The germs or vibrions which most readily and rapidly pass to the blood after death, are the septic or putrefactive, which cause the evolution of most fetid gases, by their action upon nitrogenous and superfluous matters. So that after twelve or fifteen hours, the blood of a diseased animal, which, at the time of its death, and for a few hours after, contained only the bacillus of anthrax, has now, in addition, the septic vibrio. The two are antagonistic, inasmuch as the anthrax bacillus, being ærobic, soon perishes in blood destitute of oxygen; while the septic, being anærobic, is, on the contrary, in the most favourable condition for development, and speedily invades all the fluids and solids of the body. From this circumstance, it happens that if a drop of blood is taken from the body of an animal that has just died from anthrax fever, and is inoculated into a healthy animal before it has had time to putrefy, anthrax fever only will result. But if, on the contrary, the operation is performed after a longer time, when putrefaction has taken place in the blood, then inoculation will produce at one and the same time splenic fever and septicæmia, or putridity of the blood: both being developed simultaneously, or one before the other, usually septicæmia—the septic vibrio causing death before the anthrax bacillus has had time to multiply in sufficient numbers to bring about such a result. This affords an explanation of the different conclusions arrived at by the experimentalists. Jaillard and Deplat had obtained blood which was more or less putrid, and therefore contained the vibrios of putrefaction mixed with the organisms of splenic fever; it was therefore septicæmia, and not anthrax which had killed the rabbits; and in examining their blood the septic vibrios had escaped notice, while no bacilli were observed. So that when Davaine asserted that these two opponents had not used pure anthrax blood, he was right, though he could not give his reasons. Bert's apparently contradictory result was also accounted for in the same way; he had employed blood which was more or less putrid, and as the spores of the septic vibrio perfectly resist the influence of compressed oxygen, these had not been killed, while the filaments of bacilli and septic vibrios had perished. The inoculated animals died from these spores. To prove that this was so, Pasteur resorted to the method of

successive cultivation of them in an artificial medium, and in as perfect a vacuum as possible, or in contact with carbonic acid gas, but no air, as this kills them—conditions the opposite of those in which the anthrax spores develop. From blood containing these two organisms of anthrax fever and putrid fever (septicæmia), he could produce either disease experimentally, at will, according as he cultivated the germs with or without air; or by inoculating with blood from an animal just dead from the former malady, or obtained from it twenty-four hours after death.

These discoveries clearly established the correlation between the phenomena of fermentation and those of contagion. There is no longer anything mysterious about the latter. It is simply the breeding of a living organism, or "element," in a living body, and at the expense of that body; in the same way as the organism of fermentation lives and multiplies in, and at the expense of, the dead organic matters into which it has found its way. Just as the contagious itch, or "mange," is produced on the surface of the skin by a very small insect or mite (the *Acarus scabei*); and "ringworm," also contagious and situated on the skin, is due to a microscopic vegetable fungus (the *Tricophyton tonsurans*); so are what we may term the "internal contagious disorders," some of them comparatively mild, as foot-and-mouth disease; and others most fatal—as anthrax, cattle-plague, and sheep-pox—due solely to living germs which prey upon the bodies of the animals they invade, and for whose fluids and tissues they each have a special predilection. I shall recur to this interesting feature presently. In the meantime, it may be stated that the question as to whether contagious diseases ever arise spontaneously is settled in the negative: spontaneous contagious disease has no more foundation than the spontaneous generation of organised bodies; and I need not discuss the primary origin of these diseases or the germs which occasion them, any more than I need do the origin of potatoes, turnips, dogs, or horses, when studying the attributes, derivation, or natural history of these or any other vegetable or animal body.

When studying splenic fever, Pasteur was struck by the fact that the microbe which causes it is under a particular influence which prevents it developing everywhere, and limits it to certain media which, one would think, do not differ from other media in any appreciable manner. Thus in the ox, sheep, rabbit, guinea-pig, and some other creatures, it is readily inoculable and terribly fatal; but the dog and pig have to be inoculated several times before they are infected, and even not then with certainty; while fowls are proof against the disease.

Why the latter should enjoy immunity when a large quantity of anthrax blood was introduced into its body, and an ox would succumb to a minute quantity, was found to be owing to the fact that the microbe will not grow when subjected to a temperature of 112° Fahr. The temperature of birds being from 105° to 107°, Pasteur was of opinion that their blood was too warm for the germination of the microbe, which could take away the oxygen from the blood-globules with much more difficulty than from the air in artificial cultivations; he, therefore, lowered the heat of the fowls, having previously inoculated them, by immersing their legs in water at 77°, when their temperature went down to 98° or 100°, and in twenty-four hours they were dead, their blood swarming with bacilli. To demonstrate still more forcibly that temperature was the cause of exemption in fowls, a hen, with its body heat reduced as in the other instance, after having been inoculated with anthrax blood, became feverish, and when the fever was at its height it was taken out of the water, wrapped in cotton wool, and placed in an oven at a temperature of 95°; it gradually rallied, and in a few hours was well. Fowls killed after being rescued in this way, showed no trace of Bacilli in their bodies. I have not heard that this method of saving fowls from the effects of anthrax inoculation, by raising their temperature, has been tried in the case of people suffering from "Wool-sorters' disease," or in that of animals affected with anthrax; but in the treatment of human typhoid fever, which is doubtless due to a microbe, good results have been reported from cooling the body of the patient by repeated baths in cold water. This may be due to the diminished temperature more or less arresting the fermentation caused by the disease germs.

In my work on 'Veterinary Sanitary Science and Police' (vol. ii., p. 208), I have described a disease affecting poultry, which, from some of its symptoms, and from its sometimes occurring in this century coincidently with human cholera, has received the name of "Fowl Cholera." In my 'History of Animal Plagues,' however, I have shown that it has no relationship, in point of time, with the terribly fatal scourge of mankind; and in the first-mentioned work, I have demonstrated that it differs widely from it in its pathology. It has been known from a very early period in Europe, and it has appeared in India and on the American Continent—everywhere manifesting itself as a very rapidly destructive disorder. Since 1798, it has been studied and described in Italy, Germany, and France by veterinarians and others. Delafond, who first saw the anthrax microbe, believed it to be that disease; in 1873, a veterinary surgeon of Alsace, Moritz, discovered a special microbe in the blood of diseased fowls; and in 1878, Professor Perroncito, of the Turin Veterinary

School, described this organism; while Professor Toussaint, of the Toulouse Veterinary School, also recognised it, and sent Pasteur the head of a bird that had succumbed to the malady. It had, during this century at least, been considered a most virulent disorder, readily communicable to healthy fowls by cohabitation, by inoculation, and by feeding them with food or water tainted by diseased birds.

Pasteur cultivated the germs in fowl-broth, in which it multiplies in a wonderful manner, as in a few hours the clearest decoction becomes turbid, and is found to be swarming with extremely small organisms, constricted in the middle, and motionless; but in a few days they change into a lot of isolated specks so minute, that the fluid, from being almost milky white, again becomes almost as clear as it was at first. The organism was found to belong to the kind called "micrococci"—in which class Pasteur predicted the microbes of the viruses yet unknown would probably be found. He observed that yeast-water, in which so many diverse microscopic organisms find suitable nourishment, was quite unsuitable for the growth of this microbe—indeed, it perished in it; and that the fowl-broth was the only medium in which it really flourished. The thousandth part of a drop of this mixture inoculated in a fowl would cause death; but in guinea-pigs only a small abscess appeared at the point of inoculation, and this opening spontaneously, a little pus, teeming with microbes, escapes. The virulence of this pus is extreme, and if fowls are inoculated with it they will perish quickly; but the guinea-pig suffers no disturbance in health. Rabbits appear to be as susceptible almost as fowls; so that if the pus of the abscess were smeared over the food of fowls and rabbits associating with the guinea-pig, these would die, but the latter would remain as well as ever. The excrement contains the organisms in great abundance, and it is chiefly through this that the disease is propagated in poultry yards.

Repeated cultivations do not diminish the activity or potency of the organism of fowl-cholera, which is ærobic, and cultivable in air or aerated fluids; unlike that of anthrax, however, which, when excluded from the air, in a few days disappears or is reduced to fine amorphous granulations, this may be kept for years without air, and still remain active.

In experimenting thus with anthrax virus and that of fowl-cholera, Pasteur was on the eve of his greatest discovery—the attenuation or enfeebling of the virus of contagious diseases, by which the bane could be made to serve as its antidote in the living body. The successive steps by which he arrived at an intimate knowledge of the real agents at work in the production of these diseases, will be observed to be closely related to each

other, as each was the rigorous verification, by conclusive experiment, of a preconceived idea, upon which he always worked. "Nothing can be done," he asserted, "without preconceived ideas; only there must be the wisdom not to accept their deductions beyond what experiment confirms. Preconceived ideas, subjected to the severe control of experimentation, are the vivifying flame of scientific observation, while fixed ideas are its danger."

The fact that certain contagious diseases, as a rule, affect an animal or a man only once in a lifetime, has been known from time immemorial; and this fact of non-recurrence has been acted upon in the case of some of these disorders, in producing them purposely in man and beast, in a milder form if possible, or, at any rate, under more favourable conditions, than in the ordinary accidental or natural manner. Eastern people — the Chinese, for example — looking upon an attack of small-pox as inevitable, and knowing the great mortality or disfigurement caused by the disease when caught through infection, have resorted to inoculation in order to induce a less serious and more tractable form at a convenient time. With the same object, for very many years, inoculation has been practised for sheep-pox in some of those countries—as Germany and France—where it always prevails to a more or less considerable extent. In the Russian Steppes, also, for a long time experiments were made to test the advantages of inoculating cattle for Rinderpest; and in recent years the same measure has been tried for "distemper" in dogs. In some outbreaks of Foot-and-mouth disease, cattle-owners have often produced this troublesome affection in their yet healthy animals, in order to prevent it lingering among them for a long time, and so to get rid promptly of what threatened to be an inevitable and more harassing visitation. And protective or preventive inoculation for the Lung-plague of cattle, introduced by Dr. Willems, of Hasselt, some thirty or forty years ago, has been very much resorted to in countries where that insidious and deadly pest prevails. But in all these instances the inoculation has been effected with the natural, or what we might designate the "crude" virus; and therefore the danger was great that the diseases might at times be induced in as great virulency as when they appeared in the ordinary way. This has been the case especially with Cattle-plague inoculation, which, because of the unsatisfactory results, has now been abandoned; while the benefits to be derived from Sheep-pox inoculations are perhaps more than counterbalanced by the disadvantages which attend them.

The introduction of vaccination as a protection against small-pox, by Dr. Jenner, has proved an immense success, but hitherto

it has been an unique instance of one form of disease proving an antidote to another form. Cow-pox is not the same disease as small-pox, and by no known means can it be transformed into the latter; neither is cow-pox human small-pox changed in almost every characteristic feature by transmission to the cow. Physicians and others have made the strange blunder of considering the two diseases as dependent on the same virus, notwithstanding the most obvious reasons to the contrary; and this blunder is repeated in medical books. But it is a patent fact, nevertheless, that cow-pox virus, when inoculated in man, protects him from small-pox, which the pox of no other animal will do, that I am aware of, except it be that of the camel and horse. The microbes of cow-pox find a congenial soil in mankind, multiply there, and make that soil unsuitable for the microbes of small-pox.

Why one attack of a contagious disease should render the body of a creature proof against another, for a more or less extended period, or even for the entire duration of life, is not at present known. Various hypotheses have been presented at different times to account for it, but that which has perhaps received most favour is the one that explains the immunity, by suggesting that something has been removed from the blood in the first attack which is necessary for the growth and multiplication of the disease-producing germs, and which is only slowly, or never, reproduced. In the words of Professor Tyndall, "When a tree or a bundle of wheat or barley-straw is burnt, a certain amount of mineral matter remains in the ashes, extremely small in comparison with the bulk of the tree or of the straw, but absolutely essential to its growth. In a soil lacking, or exhausted of, the necessary mineral constituents, the tree lives, the crop cannot grow. Now contagia are living things, which demand certain elements of life just as inexorably as trees, or wheat, or barley; and it is not difficult to see that a crop of a given parasite may so far use up a constituent existing in small quantities in the body, but essential to the growth of the parasite, as to render the body unfit for the production of a second crop. The soil is exhausted, and, until the lost constituent is restored, the body is protected from any further attack of the same disorder. . . . To exhaust a soil, however, a parasite less vigorous and destructive than the really virulent one may suffice, and if, after having by means of a feebler organism exhausted the soil without fatal results, the most highly virulent parasite be introduced into the system, it will prove powerless." Another theory, highly favoured by some eminent authorities, is to the effect that the microbes, during their multiplication in the body, cause the production

of some substance which is detrimental to a second invasion of them. This theory would seem to have good foundation in what is known to occur in fermentation. The poisonous substance may remain persistently in the blood and tissues, in which case immunity will be permanently established; or it may be removed in the course of time, and the body become again susceptible, and then the protection is only temporary. Both theories are perhaps equally acceptable, in explanation of what occurs.

Vaccination, as a defence from small-pox, seems to have led Pasteur to ask of himself why, if contagious maladies do not recur, there should not be found for each of them a different disease, but resembling them, which acting upon them as cow-pox does upon small-pox, would prove preventives of them? And what has been called a "chance occurrence" appears to have thrown open the way to enable him to give a reply to the question. Having shown that the microbe of fowl-cholera could be cultivated in an artificial medium for hundreds of times, without its virulence being diminished in the slightest degree, he found that this virulence could only be assured when no great lapse of time had occurred between the successive cultivations—the second culture being sown twenty-four hours after the first, the third twenty-four after the second, and so on to the hundredth or more. When several days, weeks, or even months, were allowed to elapse between the cultures, a progressive weakening in power of the microbe was apparent. So that if fowls are inoculated with the successive cultivations made at short intervals, and die in the course of one or two days, those which are inoculated with that which has been made at an interval of some weeks or months, will suffer much less and recover. But the most startling phenomenon in this respect is, that after recovering, should they be re-inoculated with the most active virus which would kill its hundred per cent. of those inoculated with it in a few hours, they will not die, perhaps even show no signs of illness: they are protected by inoculation with the delayed or attenuated cultivation.

The discovery of this power in the weakened microbe of a contagious disease, to protect an animal from the lethal action of the same kind of microbe when in full virulency, must be held to constitute the most important of Pasteur's services to medical science and to mankind; inasmuch as its effects may be of the greatest magnitude, and far-reaching, when made applicable to the many contagious disorders—so deadly and so little under the control of man—which affect our own species and the lower animals. The destructive microbe is transformed in the laboratory, by the skill of man, and at will, into a benign, life-

preserving agent. In the case of the fowl-cholera germ, the attenuating influence in operation was merely the oxygen of the air; and the proof of this is afforded by cultivating the germ in a tube having only a little air. If the tube be hermetically sealed, the microbe soon consumes the oxygen in the air and in the culture-fluid, and retains its potency for evil unimpaired, for months, or even for years. The reason why the oxygen of the air has no influence upon it during the twenty-four hours' cultivation, is explained by this being required for its nourishment and reproduction; after that time, the air gradually modifies or weakens it, until at last its power is annihilated, though the organism still lives. The experimentalist can in this way reduce, as he wills it, a virus to any degree of virulency. Pasteur could inoculate fowls with a cultivation too feeble to protect from the deadly action of the crude virus, but effectual in insuring them against a stronger cultivation. A second cultivation would nullify the action of a third, and so on until the most deadly virus was rendered inert in the bodies of the fowls. The whole secret of this protective inoculation consists in knowing at what moment a certain degree of virus attenuation is a guarantee of safety against the full-power virus.

Trials of the attenuated virus of fowl-cholera were made by veterinary surgeons and agriculturists, and with perfect success in every instance. It was found necessary to inoculate each fowl twice—at first with a very weak virus, yet sufficiently strong to prevent dangerous consequences from a stronger; then in ten or fifteen days with a less attenuated one. The preparation of these cultivations—or "vaccines," as Pasteur designates them, in honour of Jenner, as it is obvious they have nothing to do with cows in this and some other animal diseases—demands much care in manipulation and experimentation, in order to arrive at the proper degree of harmlesness and potency. Species, and even breeds, and likewise individual peculiarities, have to be tested as to receptivity, before the method can be generally applied.

When Pasteur laid before the Academy of Sciences the details of his new discovery, the importance of its bearings on medicine—human and veterinary—as well as on medical doctrines, was fully recognised by those who were competent to form an opinion, and by no one more enthusiastically than the eminent veterinarian, M. Bouley, director of the French Veterinary Schools, and whose death last November, while President of the Academy of Sciences, Medicine and Agriculture must deplore. "This is but a beginning," he exclaimed; "a new doctrine opens itself in medicine, and this doctrine appears to me powerful and luminous. A great future is preparing; I wait for it

with the confidence of a believer, and with the zeal of an enthusiast."

Having succeeded so remarkably with the plague of fowls, Pasteur was naturally desirous of extending his protective inoculation to other diseases. Anthrax was at that time being investigated in his laboratory; but as nothing was known as to whether one attack of the disease gave exemption from another, no idea could be formed whether inoculation would be successful. People who are accidentally infected from diseased animals rarely recover, and when they do, a second infection is not likely to be observed; sheep attacked with it generally all perish; but bovines are more resisting, and recoveries are not unfrequent. An opportunity occurred in 1879, in a veterinary surgeon of the Jura bringing forward a cure for splenic fever, when Pasteur was deputed by the Minister of Agriculture to report upon its value. A lot of cows were inoculated with crude virus, and one-half of the number were treated according to the veterinary surgeon's method, the other half receiving no treatment. The pretended remedy was a failure, but though many cattle died from anthrax, others survived, after being very ill. When they had quite recovered, they were re-inoculated with large quantities of the virus, but no symptom whatever of disease resulted—even when this was done after more than a year had elapsed. The question of immunity from recurrence was therefore settled, and the object now was to find a method of attenuating the virus of this malady, as he had that of fowl-cholera.

But Pasteur and his able assistants, Chamberland and Roux, met with a serious difficulty at starting. The microbe of anthrax differs from that of the poultry disease, in reproducing itself by spores, as well as by fission, the latter alone being the mode of generation in the last-named malady; while the spores may be exposed to the air for years without losing their virulence, and ready to develop into the characteristic rods, or bacilli, whenever transferred to a suitable medium. The virulence of the spore is protected from injury by its impervious covering or shell. The problem therefore was, supposing the filaments or bacilli to be analogous to those of fowl-cholera, and cultivable as a protective agent, to determine the conditions which would prevent the formation of spores. At length, after many experiments and anxious consideration, success was secured. It was found that at a temperature of 111° to 114° the anthrax microbe could not be cultivated, but that this could easily be done at 108° or 109°, at which it produced no spores. At that temperature, therefore, and in contact with pure air, cultivation of bacilli destitute of spores can be effected. But in a few weeks the crop

perishes, for when sown into a fresh medium there is no result; though in the preceding days life is still present in them. When the cultivation is exposed to air and warmth for two, four, six, or eight days, and is then inoculated in animals, its activity is found to be modified in proportion to the duration of exposure; it presents, in fact, a succession of gradually attenuated viruses, as in fowl-cholera, each constituting a foil for the uncultivated microbe.

The announcement of a method of protection from the most serious animal disease in France, was made on February 28th, 1881, to the Academy of Sciences, where it was received with great acclamation, and immediately afterwards the President of the Society of Agriculture of Melun, on behalf of the Society, invited Pasteur to give a public demonstration of his method of conferring immunity from splenic fever; this invitation he accepted, and sixty sheep were placed at his disposal. It was arranged that ten of these were to be left untouched; twenty-five were to receive an inoculation of very attenuated virus, and in twelve to fifteen days another inoculation of stronger cultivated virus. Some days afterwards these twenty-five sheep, with the other twenty-five which had not been protected, were to be inoculated with the crude mortiferous virus of anthrax.

Ten cows were also given for experiment—six to be inoculated, four not; the ten were afterwards, the same day as the fifty sheep, to be inoculated with uncultivated virus. Pasteur prognosticated that the twenty-five sheep which had not been inoculated would die, and the other twenty-five, protected ones, would survive; also, that the six inoculated cows would resist the poison, while the four which had not been inoculated, even if they did not die, would at least be extremely ill. This prediction startled many of his colleagues at the Academy of Sciences, and some of them designated it a scientific imprudence, which his laboratory experiments scarcely warranted. Pasteur, however, had perfect confidence in the result, as had also his friend and warm admirer, M. Bouley.

On May the 5th, the experiment was commenced on a farm belonging to a veterinary surgeon, M. Rossignol, who was Secretary-General of the Melun Agricultural Society. At the desire of the Society, a goat was substituted for one of the twenty-five sheep of the first lot. Twenty-four sheep, the goat, and six cows were each inoculated with five drops of cultivated virus, this being placed beneath the skin by means of a hypodermic syringe. Twelve days afterwards, these animals were reinoculated with a stronger cultivated virus; and on May the 31st, all of the cattle and sheep were inoculated with very virulent uncultivated virus. A great number of veterinary surgeons, medical and scientific

men were present, and one of the former, in order to render the trial more comparative, had an animal which had been inoculated with the cultivated virus, operated upon with the deadly material alternately with one which had not been protected. Pasteur then arranged a meeting for June the 2nd, which allowed an interval of forty-eight hours after the test inoculation. On that day more than two hundred persons — prefects, senators, counsellors, doctors, veterinary surgeons, and farmers—assembled at Melun, and it is reported that they could not repress a shout of admiration. Of the twenty-five sheep which had not been protectively inoculated, twenty-one were dead, two were dying, and the others were certain to die that evening; the goat also was dead. The non-protected cows were all suffering from intense fever, and were so weak that they could not eat, while there were great swellings where they had been inoculated with the crude virus. The protected sheep were healthy and lively, while the cows did not exhibit the slightest disturbance in health, and there was no tumour at the seat of inoculation. The most incredulous were convinced of the value and reality of the experiment, and were unable to conceal their astonishment at the victory Pasteur had gained over such a deadly disease. A veterinary surgeon who had been the most sceptical, now became such a convert that he had himself inoculated with the two cultivations, without any other accident than a slight fever; and it required all the efforts of his family to induce him to desist from inoculating himself with the unattenuated virus.

On the result of this experiment being made known through the medium of the public press, Pasteur was overwhelmed with applications for inoculating material, or "vaccine," from breeders of sheep and cattle, as well as from Agricultural Societies; so that he was compelled to institute a small manufactory in the Rue Vauquelin, Paris, for its preparation. At the end of 1881, 33,946 animals had been protectively inoculated, of which 32,550 were sheep, 1254 oxen, and 142 horses; in 1882 the number amounted to 399,102, which included 47,000 oxen, and 2000 horses; and in 1883, 100,000 animals were added to the total of the previous year. In the flocks where half had been protected and the other half had not—all herding together—the deaths from anthrax in 1881 were ten times less among the former than among the latter, being 1 in 740, against 1 in 78; in cows and oxen it was 14 times less, being 1 in 1,254 against 1 in 88. In 1883 it was proved that the protection conferred by the inoculation of cultivated virus generally lasted longer than a year; but it has been found prudent to recommend inoculation every year, performing

the operation at a period before anthrax is usually developed—in March and April; for it is recognised that such inoculation is powerless against the disease in a state of incubation—this is, when the poison is developing in the system.

If we consider that France was estimated to lose, annually, from this disease alone, animals valued at twenty millions of francs (800,000*l.*), we need not wonder at the anxiety of agriculturists to avail themselves of any measure which offered a prospect of diminishing such a serious drain upon their resources—not to mention the risk they and their labourers incurred from such a dangerous contagion, as well as the trouble of burial of carcasses, and other disadvantages which cannot be directly estimated.

A few words may now be employed in describing, in outline, the method of enfeebling or attenuating the virus of this and some other virulent diseases, in order to procure protective material, or "vaccines," for inoculation, as well as in sketching the manner of performing inoculation.

The crude virus of the disease is first sown, in minute quantity, in what is termed cultivation liquid. But in order to exclude all other germs, except those which are to be cultivated, the greatest care is necessary in order to completely "sterilise" this liquid, previous to the sowing; and everything relating to the operation — cotton-wool, filters, culture-tubes, flasks, and all implements—has to be rendered thoroughly free from germs, or sterile, by exposure to a high temperature, such as will certainly destroy all organisms (298° to 334° Fahr.). The seed-bed, or cultivation liquid itself, which is some simple infusion or decoction of suitable organic matter, is boiled for an hour at a time on two consecutive days, in glass vessels with a narrow neck, which is then plugged with baked cotton-wool; this wool intercepts the entrance of germs by filtering the air, while allowing the latter to pass through. And to make certain that all spores which may have been in the fluid at the first boiling are killed, it is maintained at a temperature varying between 89° and 90° Fahr., which will induce any that may have escaped to advance to that stage of germination at which destruction would be certain at the second boiling. After this it is kept for some weeks again at the medium temperature, still secluded by the cotton-wool; if it remains clear and limpid for that time, it is fit for sowing, but if it becomes turbid, it shows that it has been imperfectly sterilised, and is unfit for use. If every precaution has been taken, the fluid will remain perfectly limpid for months, though the cultivation-tubes which contain it are only closed by some loose cotton-wool. Instead of cotton-wool, the

tube is sometimes closed by softening its neck by the blow-pipe, and drawing it out to a very small extremity, at the same time bending it to and fro in a number of sinuous twists. At each of these bends a little liquor condenses, which detains any impurities that might be carried in by the air. When the cultivation fluid has been inoculated with the virus, the same care is exercised in excluding these impurities, and it is kept at the temperature most favourable for the growth of the germs, which soon multiply so rapidly as to make it quite opaque in a short time.

With regard to the inoculation of animals, the prepared fluid is contained in closely corked tubes, those of Pasteur holding

Fig. 9.—*Tube containing the so-called "Vaccine."*

sufficient to inoculate 50, 100, 200, or 300 sheep; and they are labelled as "first vaccine," or "second vaccine," according to the degree of cultivation. Of course, it is most important that the liquid should be perfectly pure when it is used, as if not, inflammation of the skin, blood-poisoning, &c., might occur, and the object of the inoculation be frustrated. The tubes should be kept in a cool place, as in a cellar, and a tube which is opened one day should not be kept for use afterwards, but if any of the contents is left, it should be destroyed. Inoculation is made with the ordinary hypodermic or Pravaz syringe, such as is used by medical men and veterinary surgeons. This instrument should

Fig. 10.—*Hypodermic or Pravaz Syringe for Inoculation.*

be perfectly clean and free from germs every time it is used, and in filling it, care must be taken that air is not sucked in with the fluid to be injected. The piston should work so well as to completely fill the syringe. If sheep are to be inoculated, an assistant seizes the animal, seating it on the ground and holding it by the fore legs, while the operator inserts the needle of the syringe through the thin skin inside the thigh. When completely through the skin, the piston is pushed until sufficient fluid has been introduced—the body or piston of the syringe being graduated by marks, the quantity can be measured. The needle is

then withdrawn and the skin lightly rubbed, in order to diffuse the injected material beneath it. The syringe will hold fluid sufficient to inoculate eight sheep or goats, or four horses or cows; and with a little practice a man can operate on 150 sheep per hour. In twelve or fourteen days after the first inoculation, the operation is repeated with the second or stronger fluid, the opposite thigh being selected if sheep are the subjects.

Fig. 11.—*Inoculating a Sheep with the Virus.*

With the larger animals, the inoculation is made behind the shoulder in cows and oxen, and in the neck of horses. The skin being thick, care should be taken not to bruise it in pushing the needle through. This is best done by taking up a fold of the skin and passing the needle into it, the needle being stronger than that for sheep. If the first inoculation is not properly done, there is danger that the second may kill. The appearance of a tumour at the point of inoculation in cows has been rare, but in horses, and more especially young horses, this has been noticed; but it has generally subsided without any treatment.

The experiment of inoculating young horses three times—

twice with the first vaccine, and once with the second—has resulted favourably, no tumour appearing. This may prove to be the best method of inoculation for horses.

It may be interesting here to remark that, whether moved thereto by Pasteur's success in protecting poultry from fowl-cholera, or inspired by some other influence, there were other investigators of this disease in the field, who came near the goal which was subsequently reached by the indefatigable master. In 1880, Dr. Toussaint, of the Toulouse Veterinary School, published the results of his inquiries and experiments, and we learn that for nearly four years he had been almost exclusively occupied with the study of anthrax, and especially practising experimental inoculation of its virus. These experiments led him to the discovery that sheep and rabbits were protected by injecting beneath the skin anthrax blood deprived, he believed, of the bacilli, either by filtration, heat, or even antiseptics. He preferred heating fresh blood from a diseased animal to a temperature of 131° Fahr. for ten minutes, adding to it one-half per cent. of carbolic acid. A small quantity of this injected beneath the skin, gave rise to slight fever in three or four days, but which subsided on the fifth day. Inoculation with very virulent anthrax blood on the fifteenth day afterwards, produced no effect; so that the animal was proof against it. When injected at the same time as the heated material, however, death ensued.

Toussaint had, therefore, the priority of two years in discovering a means of securing immunity from anthrax, in modifying its virus by heat; but, unfortunately, his simple method has not been found to possess the advantages or safety of Pasteur's cultivations, though Chauveau has endeavoured to improve it.

Very early in 1878, Dr. Burdon Sanderson, the Superintendent of the Brown Institution, having received a money grant from the Royal Agricultural Society, undertook some experiments in anthrax ('Journal' of the R. A. Society, vol. xvi., p. 257), in which he succeeded in rendering cattle proof against the lethal inoculation of virus, by first passing the latter through the body of a guinea-pig, which it had killed. "The rodents die, but the bovine animals inoculated with their blood or with the pulp of their diseased spleens, recover." And he adds: "The question whether this fact, like the analogous one of the mitigation of human small-pox by transmission, can be directly applied to a practical purpose, I leave to be determined by future inquiry. Its present interest lies in its bearing on the nature of the process of infection in anthrax." In 1879 and 1880, the experiments were continued by Sanderson's successor, Dr. Greenfield, and

those who read his reports in the Society's 'Journal' (vol. xvi., p. 273, vol. xvii., p. 30), will find that Pasteur's discovery of anthrax protective inoculation by means of cultivated virus, was nearly, if not quite, anticipated by the liberal action of the Society and the scientific ability of its agent. Dr. Greenfield, in his second report, published at the commencement of 1881, concisely gives the object and the result of his investigations, from which it will be seen that, so far as immunity from the disease is concerned, they were the same as those of Pasteur.

"In the course of these experiments, it has been my endeavour to ascertain whether any modification of the poison of the disease could be artificially produced without the employment of animals for the production of the modified virus. With this object, I have made a series of experiments, cultivating the virus artificially in organic fluids, and I have been able to prove that it is capable of gradual attenuation, even to the degree of complete destruction of its virulence, and it may thus be greatly modified, so that a certain degree of poisonous activity may be attained at will." The details of the experiments given, quite corroborate his statement. Unfortunately, we have no Academy of Sciences in this country; and though our agriculture has been most terribly damaged by the ravages of pestilential diseases among animals, yet little attention has been paid to them. Consequently, the Society's efforts and Dr. Greenfield's anticipatory discovery, have, it must be confessed with regret, been allowed to drop out of sight. If we compare England with France, or some other countries, in this matter, we have small cause to congratulate ourselves.

The brilliant success attending Pasteur's public demonstrations in his own land, naturally attracted great attention in other continental countries which suffer quite as much loss as France from the destructiveness of anthrax, and some of these were eager to satisfy themselves as to the efficacy of inoculation, by a trial on their own territory. Hungary made a request, through Baron Kemeny, Minister of Agriculture, for M. Pasteur to make an experiment at Buda-Pesth; this was complied with, M. Thuillier, one of Pasteur's assistants, and who has since died from cholera while investigating that disease in Egypt, having been sent to the capital of Hungary to conduct the official trial in September 1881. A Commission was appointed to watch the experiment, Baron Kemeny being President, with the chief professors of the Veterinary Institute and of the Faculty of Medicine as members. Sixty sheep and ten bovines were provided, but some of the animals were weakly, and others were suffering from various diseases not apparent before inoculation. One-half of the sheep and one-half of the cattle were set aside

as test animals, to be inoculated with the crude virus only. Two of the sheep inoculated with the cultivated virus died from non-specific disease before the final test. When all were treated at last with the deadly virus, the efficacy of "vaccination" was fully verified by the resulting deaths in those not protected, and the immunity of those vaccinated. The Buda-Pesth experiment was repeated at Kapuvar on one hundred sheep and twenty oxen; fifty of the former and fourteen of the latter being "vaccinated," and fifty sheep and six oxen being reserved for tests. Fifty-nine sheep and one test cow died after virulent inoculation, and the surviving sheep and three of the cows were very seriously ill. One vaccinated sheep died, the other sheep and oxen not being affected. Twenty-six sheep of a flock ravaged by anthrax were also protectively inoculated. After the second inoculation ten of these died, and nine again subsequently.

This experiment was considered unsatisfactory, and the reason for its being so was explained by Pasteur as being due to the first inoculation material, which Thuillier took with him from France, being too weak to resist the effect of the second—it had been, unknown to Pasteur, "over-cultivated."

Prussia made application for "vaccine virus," but as the value of Pasteur's discovery was formally contested in Prussia, by Koch and others, Pasteur decided that it would be better to have a demonstrative experiment like that which had been made at Pouilly-le-Fort, Melun. Dr. Roloff, director of the Berlin Veterinary School, took the initiative in this step, by applying to the German Minister of Agriculture to have the experiment made, and to nominate a Commission to report on it. This was agreed to, and the Commission—with H. Beyer, Member of the Superior Council of Government, as President, and Dr. Virchow, Count Zieten-Schwerin, Councillors Zimmerman and Rimpau, several Veterinary School directors—Dammaun, Leisering, and Seidamgrotzky, and several of the leading veterinary surgeons from different parts of Germany, members. Twelve cattle and fifty sheep were collected at a place called Packish, where anthrax had prevailed to a large extent for some time, attacking horses, cattle, and sheep. In one year alone, seven horses, sixty-two cattle, and twenty-two sheep died; and it is to be noted that the outbreaks were more frequent when the animals grazed on certain parts of the field, or when these parts were mown for stall-feeding. The farmer had used this field as the burial-place for animals which had died from anthrax, while other carcasses he put in the manure-heap, which was in due course distributed over the land. The cattle and sheep for experiment were brought from an infected locality, and were divided in two equal portions; and twenty-five sheep and six

cattle were inoculated with the primary vaccine without any unfavourable symptoms following. After the second inoculation, however, several of the cattle and sheep became very ill, and three sheep died. The cattle and remaining sheep were soon quite well, and were inoculated with very virulent blood, at the same time as the other half of the animals kept for test purposes. All of the former continued perfectly well, but all the sheep and three cattle of the latter perished from anthrax. The experiment demonstrated that Pasteur's protective inoculation gives the inoculated animals complete immunity; but its practical utility was doubtful, as 12 per cent. of those inoculated succumbed to the second inoculation. Pasteur was of opinion that the breed of sheep had something to do with this result, so different to that observed in France; and the Minister of Agriculture, accepting this view, put the entire flock of sheep on the farm at his disposal. These were subjected to experiment; and fifty-two head of cattle on another farm were inoculated protectively. None of the cattle died; and the result with the sheep was more favourable than that in the first experiment.

The conclusions or inferences arrived at from these two sets of carefully conducted and closely supervised experiments, were to the following effect:—

"1. Cattle which withstand inoculation with the cultivated material, do not contract the natural form of the disease.

"2. The weakest cultivated fluid (*premier vaccin*) did not produce any sign of disease, either in cattle or sheep.

"3. The second inoculation, with the more virulent cultivated material (*deuxième vaccin*), produced a decided rise of the internal temperature and illness, although this was not, as a rule, fatal. At the seat of inoculation, various-sized nodules or swellings formed, which were either painful or painless. None of the cattle died after the second inoculation, but three sheep of the twenty-five used for the first experiment, and one of the 251 of the second, perished.

"4. The controlling experiments with the blood of an animal that had died of anthrax, and with the virulent fluid from Pasteur's laboratory, produced only a slight disturbance in the cattle and sheep that had been previously protected by the cultivated fluids; those animals which had not been so protected, however, became very ill indeed. Of the twenty-five sheep in the first experiment, and which had been inoculated with the protective fluid, none died; of the twenty-four in the second experiment, two lambs succumbed—one fourteen days after inoculation; but both were weakly animals, which may account for this unfavourable result."

From this it will be seen that the report of the Commission, to which Germany seems to have attached so much importance —judging from its composition—was entirely in favour of Pasteur's discovery; and it was concluded that on large farms where anthrax is more or less prevalent, it would be advantageous and economical to protect the animals (*herbivora*) by inoculation, especially the cattle, as it is not so dangerous for them as sheep, while they are more valuable.

It should be stated that all the sheep and cattle remaining from the experiments, and which had been protected, had been turned out to pasture upon the infected farm, and seven months afterwards they were still in good health; though some of the lambs born from the ewes subsequent to the experiments died from anthrax.

There can be no doubt that in countries or localities where the malady prevails, protective inoculation, when properly practised, must prove an immense boon. In India, for instance, which is in the unenviable position of having nearly, if not altogether, every contagious disorder to which animals are liable —cattle-plague, foot-and-mouth disease, sheep-pox, glanders, rabies, anthrax, &c.—causing a loss, at the lowest estimate, of six million pounds sterling a-year, and with scarcely any attempt at a remedy—protective inoculation for the prevention of anthrax among horses alone would prove of great benefit to our mounted corps there. And what would it not save if it could be applied to all these devastating plagues of animals which revel almost unchecked all over India? Already the possibility of obtaining such benefits have been shown by Mr. Mills, of the Army Veterinary Department, who at Madras, in 1884, conducted a series of experiments on ponies, donkeys, cows, bullocks, buffaloes, sheep, and guinea-pigs—in all 88 animals, with marked success. And Mr. Frost, of the same Department, appears to have been equally successful in Burmah; so much so, that the agents of the Bombay-Burmah Trading Corporation have expressed their intention of having their elephants in the Mingyan and Chindwin Valley forests inoculated against attacks of anthrax, which is very destructive to these creatures in that country.

Some parts, and often the best, the fertile *vleys* or valleys of South Africa, are deadly localities for horses at certain seasons of the year, because of the dread *Paard Ziekte* (horse-sickness). That this is a germ disease there can be no doubt whatever; because a horse that has recovered from it, which is rare, is believed to be safe from another attack—is what is called "salted," and is therefore very much more valuable than one which has not had the disorder. Besides, the germ which causes it has been identified, and successfully inoculated in guinea-pigs.

The disease is of the nature of, if not identical with, anthrax; and the Pasteurian inoculation would, it may safely be predicted, protect all the South African horses in the places where they would perish wholesale, if exposed.

In an immense empire like our own, the greater portion of which is agricultural, and nearly every part of which is haunted and harassed by contagious diseases among the animals useful to man, and so essential to his welfare, this method of guarding against disorders which are generally fatal, and rarely amenable to medical treatment, should have wide and most beneficial application, and especially when it can be resorted to for all of these maladies.

But to return to Pasteur's researches in anthrax.

Still pursuing his investigations with regard to that disease, and fowl-cholera, and having subdued the virulence or microbe of these to his will, bringing them down to a point where they could not multiply in the bodies of animals inoculated with them, and still keeping these organisms alive in suitable media, he demonstrated that these now non-virulent microbes could be restored to their pristine activity, and rendered capable of living and multiplying in the blood of animals. An attenuated anthrax virus which would not affect a guinea-pig even a week old, will yet kill one just born, or one or two days' old; and if some of the blood of this is inoculated into an older one, this also will perish; while should the blood of this, again, be injected into a still older one, this will succumb; and so on through a series, until at length the blood has acquired such power that the old guinea-pigs, sheep, and finally oxen, are unable to resist the smallest drop of it. It is the same with fowl-cholera. The most attenuated and harmless cultivation of the microbe can be made as deadly as ever, by passing it successively through small birds and chicken, until it is capable of destroying full-grown poultry.

The attenuation of the poison of contagious diseases by the air, suggested to Pasteur the possibility of the great epidemics of mankind (and for that matter also, the epizoötic diseases of animals), being modified or extinguished, and reappear or become more intense, through the same agency. "The accounts which I have read of the spontaneous appearance of the plague in Benghazi in 1856 and 1858," he says, "tend to prove that this outbreak could not be traced to any original contagion. Let us suppose, guided by the facts now known to us, that the plague, a malignant disease peculiar to certain countries, has germs of long duration. In all these countries its attenuated virus must exist, ready to resume its active form whenever the conditions of climate, of famine, or of misery present themselves afresh. The

condition of long duration in the vitality of the germs is not even indispensable; for, if I may believe the doctors who have visited these countries, in all places liable to the plague, and in the intervals of the great outbreaks of the epidemic, cases may be met with of people attacked with boils, not fatal, but resembling those of the deadly plague. Is it not probable that these boils contain an attenuated virus of this disease, and that the passage of this virus into exhausted bodies, which abound only too freely in periods of famine, may restore to it a greater virulence? The same may be the case with other maladies which appear suddenly, like typhus in armies and in camps. Without doubt, the germs which are the cause of these diseases are everywhere scattered around, but attenuated; and in this state a man may carry them about with him, or in his intestines, without suffering much, if any inconvenience. They only become dangerous when, through overcrowding, and perhaps successive developments of them on the surfaces of wounds, in bodies enfeebled by disease, their virulence becomes exaggerated."

The manner in which animals became infected with anthrax also engaged Pasteur's attention, now that it had been definitely established that it was due solely to a microbe or its spores. This organism is now well known to all pathologists as a rod-shaped body, multiplying, when allowed oxygen or air, by dividing across, and measuring from $\frac{1}{1250}$ to the $\frac{1}{2500}$ of an inch in length, and about $\frac{1}{1800}$ of an inch in breadth. It has an outer case or sheath, and inside this is fine granular protoplasm, the vital part of the organism. In this the spores appear as glistening points, which gradually become ovoid, and increase in size by the protoplasm collecting closely around them, until they fill the rod or sheath, like peas in their pod; the sheath now either breaks off in segments, which burst, and the spores are set free; or it becomes softened and dissolves, leaving them at liberty in the middle of the pulp. These, as has been already mentioned, are extremely tenacious of vitality, and develop into the rod-like bodies or bacilli, when cultivated artificially, or introduced into the blood of animals.

When sheep, cattle, or horses at large become affected with anthrax, this must be due to their receiving the spores from some external source; and that this may be the pasturage, was proved by an experiment, in which several groups of sheep were fed on grass which had been sprinkled with artificially-grown bacilli or their spores. Some died from anthrax, and many survived after having been visibly affected—the period of latency being in some cases eight or ten days, in others much less. If prickly or stubbly plants, however, were added to the infected herbage, the

mortality was very much increased. Experiment also confirmed the view to which this artificially infected herbage gave rise, that pastures become tainted by the excreta, which are often bloody, of living diseased animals, and by the blood and *débris* of those which have died or been killed, and buried on the spot. Adding some anthrax-blood to earth which had been sprinkled with yeast-water or urine, and keeping this at summer temperature, or at that which the fermentation of a dead body sets up around it—as in a dung-heap—the bacilli of the blood had, in less than twenty-four hours, multiplied and developed spores. Afterwards these spores were observed in their latent or resting condition, ready to germinate and produce the disease in animals, perhaps years afterwards.

To ascertain what really happens in ordinary circumstances, the earth from a grave in which a sheep that had died of anthrax from natural infection, and the carcass of which had been inspected by Pasteur and his assistants, was examined ten and fourteen months after that event, and was found to contain spores of the bacillus. Guinea-pigs inoculated with these spores died from anthrax. The same experiment was successfully made with soil from the surface of the grave which had not been disturbed since the burial of the sheep.

Experiments were carried out with earth obtained from trenches, in which the carcasses of cows dead of the disease had been interred at a depth of more than six feet two years before. Material was procured from this soil, which at once produced the disorder. On three occasions this happened, though nothing of the kind was exhibited in the earth from around these trenches. Notwithstanding the operations of ploughing, sowing, and reaping, the surface-soil of the graves still contained anthrax-germs. From the carcasses of the dead animals the earthworms bring these germs, as well as those of putrefaction and others, to the surface; and these otherwise useful creatures, themselves unaffected, become the indirect cause of the disease in animals which graze on such ground.

M. Tisserand, Director of Agriculture in France, has remarked that the malady is unknown in the Savarts of Champagne, although this locality is surrounded by districts which are notoriously infected; if it chances to appear, it is owing to its introduction from without. Here the arable soil is not more than four or five inches thick, and lies on chalk; so that it is unfavourable for worms, and therefore the germs in the bodies of dead animals will remain in them, and the soil will not be tainted. It is on soils of the opposite character that anthrax is most likely to prevail, if anthrax-infected bodies are buried in them. Impressed with this knowledge, Pasteur recommends that

such bodies should never be buried in fields intended for cultivation, forage, or for pasture. If possible, a sandy or poor calcareous soil, dry and readily desiccated, should be selected, as it is not suited for earthworms.

But with all due deference to M. Pasteur, I would urge that, whenever and wherever animals die from germ-diseases, they be not buried, but burned. This is the only safe procedure with contagious maladies, and particularly in countries with rich and heavy soils ; it is that which is resorted to by military veterinary surgeons in India, in disposing of the carcasses of horses which die from that form of anthrax known as "Loodiana Disease" so named from the country in Hindostan in which it was first noted as most prevalent.

While we are on this subject of anthrax, it should be mentioned that a disease which was, until three or four years ago, considered as one of its manifestations, is now distinguished as a different malady, but, like it, is due to a microbe capable of artificial cultivation, and is then protective from the disease when inoculated. I allude to a most fatal disorder of young stock with which cattle-breeders in this country and in our colonies are only too familiar, and which, among a variety of local names more or less peculiar or significant, is perhaps best known as "Black Quarter," but which is now technically designated "Carbuncular Emphysema, Erysipelas," or "Symptomatic Anthrax." It usually attacks the most rapidly thriving of young bovines, its onset being remarkably sudden, and its course strikingly rapid, the termination being almost invariably fatal. The chief symptom is sudden lameness—generally in a hind limb, swelling of the quarter from which, if the skin covering it is pressed upon, a crackling sound is emitted, due to the disengagement of gas from the large quantity of dark blood thrown out beneath, and which forms such a characteristic feature on dissection after death, as to give the disease its familiar name of "Black Quarter."

Incited thereto, probably by Pasteur's example, Arloing and Cornevin, Professors at the Lyons Veterinary School, and Thomas, a veterinary surgeon at Bassigny, France, have studied this malady, known as "Chabert's disease" in that country, and have demonstrated that it is very different from anthrax, in that it is not communicable by inoculation of the blood, which that disorder most certainly is ; that its microbe is like a large bacillus, but moves, and is only found in the affected limb among the serum, or deep among the muscles, to the fibres of which it adheres so closely that it can only be removed by scraping with a sharp knife ; and that this organism, when injected into a vein, causes only a slight and brief disturbance of health, whereas the

anthrax microbe would assuredly kill. Death is more rapid in this disease than in anthrax, and the spleen is not involved, as in it. But the most valuable part of their discovery lies in the fact they have established—that this direct (intravenous) injection safeguards the animals so operated upon from the mortal effects of the disease, either naturally or artificially, which occurs when the virus is introduced among the muscles. The protection has been found to last for more than two years; as cattle which had received the virus at that time were inoculated with a quantity of virulent muscle-pulp, but remained unaffected, while another bovine, which was unprotected, died on receiving one-tenth part of the dose. The virus does not seem to be capable of attenuation by cultivation, and its introduction into the blood through a vein is the most effective, and hitherto the most simple, means arrived at to save cattle exposed to infection from death.

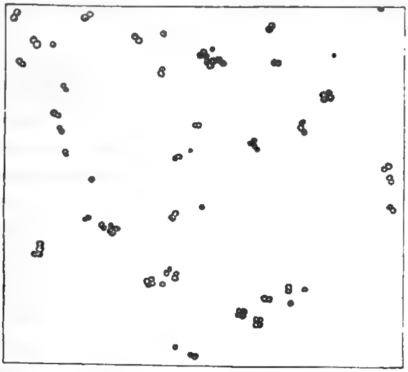
This method, however, demands careful manipulation to prevent the inoculating material from escaping into the space between the skin and the vein, where it would set up the disease itself, and speedily destroy the animal.

It may be remembered that, a few years ago, Dr. Burdon Sanderson undertook some experiments for the Royal Agricultural Society, in contagious pleuro-pneumonia of cattle, in which he sought to ensure protection by introducing the virus through a vein into the blood, instead of beneath the skin of the tail, as in the ordinary procedure. And as with "Black Quarter," so with this disease. The intravenous injection of the virus appeared to ensure perfect immunity against the lung disease; but there was great danger lest any of the virus should get beneath the skin during the operation, as it would give rise to so much local and general disturbance as in all likelihood to cause death. The microbes of the two diseases, while producing very little derangement to the health when imported directly into the blood stream, though bringing about such changes as will prevent attacks of their special maladies, yet find such a congenial *habitat* in the connective tissue immediately beneath the skin, as to multiply in appalling numbers within almost a few hours, and thus to destroy life. The safety of tail-inoculation for Lung Plague is probably to be found in the very small amount of connective tissue in that part, though the operation is no less certain in its results, so far as protection is concerned.

Pasteur has given his attention to another disease with which agriculturists, and pig-breeders and feeders, are only too well acquainted. I allude to Swine-plague, known in France as "Rouget," and in Germany as "Rothlauf." This malady has for some years assumed such a virulent and deadly character,

and has attained such widespread dimensions in Europe and the United States of America, as to threaten the extinction of the porcine tribe within a brief space, if prompt sanitary or protective measures are not adopted. From its superficial resemblance to anthrax, it was long looked upon as a form of that disease; but by Dr. Budd and a few veterinary surgeons, it was considered to be analogous to typhoid fever in man, and was consequently designated "Pig Typhoid." In August, 1875, having had the opportunity, while with the Royal Engineers at Chatham, for the first time of examining some pigs that had died of this disease at Higham, near Gravesend, I came to the conclusion that it was neither anthrax nor typhoid fever, but a distinct disease of the swine tribe.* Some time after this (1877), Dr. Klein came to the same conclusion, and others were subsequently of this opinion ; so that it is now decided that it is a disease peculiar to the pig. So far as experiments have shown,

Fig. 12. *The Organisms or Micrococci of Swine-plague.*



it can only be transmitted by inoculation to the rabbit, mice, and white rats, among mammalia ; and among birds, according to Pasteur and Thuillier, Cornevin, and some other French investigators, the pigeon can be infected—very readily, say the first-named authorities,—but Klein denies this receptivity in pigeons. It is most infectious and contagious among pigs, in which it appears in two forms :—acute and chronic ; and its maintenance is due to an ærobic germ, different from that of anthrax in being in the form of minute round granules or "cocci," single or double, as in a figure of 8, slightly motile, isolated, or collected in groups of two, three, or four. These are easily cultivated in the same

* "A Fatal Eruptive Fever in Pigs."—'Veterinary Journal,' October, 1875, p. 269.

manner as the anthrax rods or spores. The discovery of the microbe was made by Detmers in America (1882), and about the same time by Pasteur and Thuillier in France. Klein had previously found a bacillus, but this is not now acknowledged as the active agent. The germ exists throughout the body of the diseased pig, and especially in its *excreta,* which are very virulent. Infection is easy by the digestive organs; and, besides other modes of contamination, the food may receive the microbes by diseased mice, or through the medium of rats, flies, birds, &c.

In 1883, Pasteur made known a method of attenuating the virus, which, simple and effective, offers as certain protection against swine-plague, when inoculation is properly performed, as anthrax inoculation does against that malady. He found that when a pigeon was inoculated in the chest with the microbes of the disease, it died in six or eight days. When a second pigeon was inoculated from this, a third from it, and so on in succession, the microbe acclimatised itself in pigeons; so that death ensued more rapidly, and the blood of the last pigeon assumed much more virulence when introduced into pigs, than the most infectious products of a pig that had died of the natural disease. But the passage of the microbe through rabbits had quite a different result. When inoculated from a diseased pig, these creatures all speedily perished, but cultures of their blood in sterilised media became progressively easy and more abundant, the microbe somewhat changing in appearance. When pigs were inoculated with the blood of the last rabbits, and the results were compared with those obtained from the first, it was discovered that the virus had gradually lost its power; and though the blood of these rabbits made pigs very ill, it ceased to kill them. On recovery, they were proof against the fatal disease.

In various parts of France, this swine vaccination has been carried out; but perhaps the most carefully conducted and extensive experiments were carried out in the Grand Duchy of Baden, in 1884, to test the value of the measure. In that country swine-plague had caused heavy losses for many years, and in 1865 and 1871 commissions were appointed to report upon it. In 1884 it was arranged that a trial of vaccination should be made, under Pasteur's direction, the experiments to be carried out by one of his assistants, and the inoculating material and instruments to be supplied from his laboratory. The experiments were carried out at fifteen places on 237 pigs of different breeds and ages, and were under the observation of selected veterinary surgeons from Berlin, Munich, Stuttgart, Hesse, Alsace-Lorraine, Luxemburg, and Berne, as well as others. All the pigs were in perfect health, and the inoculations were performed in a similar manner to those on the sheep

at Berlin. One-half the number were kept as test animals, and were not protectively inoculated. The second vaccination was made twelve days after the first, no ill effects following, except to six animals; and the final test was applied to all the pigs, in another twelve days, either by inoculating them with the deadly virus, or by feeding them on food mixed with it. The experiment was as conclusive as that at Pouilly-le-Fort, with regard to anthrax. The pigs which had been protectively inoculated were unaffected by the crucial test, while those not so indemnified nearly all succumbed to the natural or imposed infection.

Rabies in animals is a disease which concerns people in general, from its terrible character when communicated to mankind as Hydrophobia; but to agriculturists it possesses additional interest, because, in addition to the danger they personally incur, the losses they are liable to sustain among their stock from the bites of rabid dogs are by no means insignificant at times, in localities where the scourge prevails.

Pasteur, busy in his laboratory investigating different diseases of the human species—typhoid fever, a serious bone-disorder, boils, puerperal fever in woman—in all of which he found special organisms, whose action he endeavoured to annul, applied himself more especially to the study of hydrophobia, which, for a long time, had occupied his mind. He had been particularly struck by the peculiar view entertained by many physicians, and others, that this fatal disease was largely, if not altogether, due to mental excitement, and that contagion had little if anything to do with it. Of course, these physicians were not acquainted with veterinary medicine, and had no experience of rabies in animals, else their imagination could not have so misled them. An opportunity occurred for him to collect some of the mucus from the throat of a child a few hours dead from the malady. With this he inoculated some rabbits beneath the skin, and they died in thirty-six hours; their saliva conveyed the disorder to other rabbits. There was nothing at all novel in this, as rabbits had been infected through experimental inoculation years before. But death had been so rapid in Pasteur's rabbits, that there was no time for them to have had the disease. More rabbits were inoculated, and in the blood and tissues of those dying and dead he found a special microbe, which was easily cultivated in sterile infusions, and produced death in other rabbits, reappearing in them. This organism was also discovered in the saliva of children suffering from other maladies, and was not therefore special to hydrophobia. Grown in successive cultivations at twelve hours' interval, its virulence remained undiminished; but if allowed to

remain longer in contact with the air it became enfeebled, and attenuated cultures could thus be obtained; these inoculated in other rabbits were found to prevent the action of the strong virus. Though both ærobic and anærobic, the air destroyed its potency very quickly; but kept from the air, it retained its deadly character for months. It is much to be regretted that Pasteur has not stated whether he tried dogs with this microbe; as its discovery, it must be acknowledged, did not advance the question as to the exact cause of rabies.

The incubation of rabies is so uncertain, and sometimes so protracted, when produced in the ordinary way, that Pasteur became tired of waiting for months for the results of his inoculations, and therefore sought a more certain and rapid means of developing it. At length he could make it appear by introducing portions of the brain and spinal cord of dead rabid animals beneath the skin of dogs and rabbits, and this nervous matter could be kept in a state of purity for a long time; whereas rabific saliva was always impure, and lost its potency in twenty-four hours.

A happy thought induced Pasteur to place this pure nerve-virus on the surface of the brain of a dog, by trephining its skull while it was under the influence of chloroform, and it became rabid in a few days. Other dogs were treated in the same way, and nearly all yielded to the malady in less than twenty days. This showed that in the nerve substance the poison of rabies exists in its most concentrated form, and especially in the brain and upper part of the spinal cord (medulla oblongata)—the microbe of the disease evidently flourishing there most luxuriantly; though the virus is also localised in certain salivary glands and mucous surfaces; all of which peculiarities may account for differences in symptoms in cases of hydrophobia. It was ascertained that the disease could be developed in an animal by passing infected brain-matter into its blood, through a vein, almost as quickly as by trephining.

For a number of years, in this country and on the Continent, by means of the microscope, extremely minute round bodies have been noticed in and around the upper part of the spinal cord and brain of people and animals dead from the disease; these were also observed in Pasteur's laboratory, and it is not at all improbable that they are the germs of rabies.

When the virus was passed through a certain series of monkeys, it gradually lost its power, until it was so enfeebled that dogs inoculated with it did not suffer from rabies, but were, on the contrary, rendered insusceptible to rabific inoculation. By such means Pasteur succeeded in rendering some sixteen out of every twenty dogs he inoculated refractory to rabies.

But remarkable and important though this result might be considered, he became impatient at having to wait for months before he could assure himself that such animals were really rendered proof. He therefore set about to find a method by which he could produce viruses of different degrees of strength, so that he might obtain more certain, more prompt, and more practical results.

This he at last effected by inoculating a rabbit on the brain with a portion of the spinal marrow of a rabid dog—this caused the disease to appear in about fifteen days. The virus was passed on to a second rabbit in the same way, and from this through a number—twenty to twenty-five—when the interval of latency was reduced to seven days. This happened with the greatest regularity in the experiments; and though the inoculations from rabbit to rabbit were carried up to ninety, the incubation period could not be reduced much below seven days. It may be mentioned that the experiments were carried on for more than three years without interruption, and without having recourse to any other virus than that of the successively infected rabbits.

Consequently, nothing was easier than to have constantly on hand a supply of rabific virus, perfectly pure, and always of the same quality or potency; and this was the practical feature of this long and laborious inquiry into the method of inoculation. The spinal cord of these rabbits was equally virulent throughout its whole extent, and if slices from it were removed, with all precautions to maintain their purity and freedom from putrefactive germs, and suspended in dry air in flasks (air dried by placing fragments of caustic potass at the bottom of the vessels), their virulence slowly disappeared until it vanished altogether—the rate of disappearance depending upon the thickness of the slice, each spinal cord being cut up into fourteen or fifteen pieces. Temperature also influenced its disappearance; as the lower this was, so the longer was the virulence maintained. If kept in carbonic acid gas, in a humid condition, air being excluded and no foreign microbes admitted, the pieces of nerve-tissue would remain potent for at least several months. These results constitute the scientific feature of the method.

When it was desired to render a dog refractory to rabies in a relatively brief period, a fragment of fresh rabific spinal cord from a rabbit dead seven days after inoculation, was suspended every day in a series of flasks, the air in which was dried in the manner above mentioned. Every day also the dog was inoculated beneath the skin with a morsel of this dried spinal cord mixed up in a little sterilised broth—commencing with the oldest fragment, to make sure that it was not too virulent;

each day a more recent fragment (an interval of two days' drying between each piece), until the last was reached, and which was very virulent, being only one or two days in the flask. After this the animal could be inoculated beneath the skin or on the surface of the brain with the most active virus, and rabies would not follow.

Pasteur had inoculated fifty dogs of all ages and breeds, and rendered every one of them proof against the disease, when, unexpectedly, on July 6th, 1885, three individuals from Alsace arrived at his laboratory; two of them brought a boy nine years old, said to have been worried by a rabid dog on the 4th of that month, and the wounds, fourteen in number, gave evidence of this. Two professors of medicine saw the boy on the same day as Pasteur, and from the history of the case and the nature of the injuries, it was considered a desperate one—death from hydrophobia appearing inevitable.

Pasteur therefore decided, though not, it may be imagined, without grave misgivings, to practise on this child the method of protection which had invariably succeeded with dogs, even *after* they had been bitten by rabid ones. The step was a terribly venturesome one, and nothing but the apparently hopeless position of the patient, and the confidence in his method begotten by uniform success, could have endowed him with courage, or inspired him with hope, in undertaking by far the most formidable and most anxious task of his lifetime.

The disease is horribly agonising and dreadful—more so, perhaps, than any other which afflicts humanity; and while Pasteur was naturally anxious to save the boy from it, the risk was fearfully great that the very means employed to do this might produce it.

On the evening of July 6th—sixty hours after he was wounded—the boy received the first subcutaneous injection of spinal marrow, obtained from a rabid rabbit fifteen days before, and kept since then in a flask of dry air. The following days' inoculations were made in the same region—beneath the skin of the abdomen; so that thirteen inoculations were given in ten days, though Pasteur believed that a less number would have sufficed. The pieces of spinal cord had been dried from fourteen days to one day; and inoculations on trephined rabbits, made at the same time, showed that the five oldest specimens were not virulent, because they did not induce rabies; while the five subsequently dried ones were all active, their virulence being proportionally greater as they were more recent, until the last killed in seven days. During the latter days, therefore, the child had received, successively, quantities of rabific matter, the last of which was so deadly as to destroy rabbits in seven days and

dogs in ten—matter more virulent even than the poison of the rabid dog, because it had become intensified in its passage through the long series of rabbits.

This extreme virulence, though it might give rise to the gravest apprehensions, so far as the safety of the unfortunate child was concerned, yet had the advantage of limiting the duration of these apprehensions; as if it produced the disease at all, it must do so sooner than the ordinary dog virus would. But up to the time of writing this paper, the child remains unharmed—a living testimony to one of the most wonderful and valuable discoveries in medicine of this age, or perhaps of any time: a discovery vastly greater than Jenner's vaccination, great as that was.

Commencing with the discovery and the mastery over the microbes which destroy the stability of simple organic compounds and cause fermentation, by consistent reasoning, persistent experimentation, and profound — almost instinctive— powers of discernment, Pasteur advanced step by step along the same path, until he controlled, we may say vanquished, that form of fermentation, also due to micro-organisms, which destroys the life of man and beast. The most intense virus introduced into the body, either naturally or experimentally, had no power whatever for mischief after his protective inoculations; indeed, it seemed rather to consolidate and confirm the refractory condition with which these inoculations had endowed the individuals so protected.

It may well be imagined that Pasteur's boldness in venturing from animals to mankind, in his attacks upon disease, startled the medical world and the public more than anything he had yet attempted, and this all the more when the malady he dared to grapple with was hydrophobia—the mere mention of which seems to conjure up feelings of dread and panic. By many, the successful issue of the inoculations which the first patient had undergone, and that of the large number of people submitted to them subsequently, was received as a sure guarantee of immunity, even after several days had elapsed since injury was inflicted by rabid dogs. For Pasteur had proclaimed that, though a certain number of days (thirty) might have transpired after a person had presumably received infection from a mad dog, yet his attenuated virus, administered in the way described, anticipated the action of the slower-operating poison, and neutralised it. But in dealing with this, the most uncertain and hitherto intractable of all maladies, it was perfectly reasonable that many who were not at all prejudiced against the wizard of the Rue d'Ulm, but were, on the contrary, his enthusiastic admirers, should hesitate before accepting this latest and grandest con-

quest as absolutely demonstrative of his power over such a disease. The oftentimes very protracted period of latency or incubation, and the uncertainty of inoculation from rabid dog-bites—only a comparatively small proportion of those wounded suffering subsequently—caused many who knew the disease to withhold their applause until they saw whether the results of the experiments on animals could be applied to man with the same certainty and safety. But so far as matters have progressed up to the present time, there is every reason to believe that the most sceptical will soon have reason to acknowledge the genuineness of this splendid triumph in prophylactic medicine.

On March 1st of this year, Pasteur announced to the Academy of Sciences that he had inoculated no fewer than 358 persons, many of whom had been bitten by really rabid dogs, and the others by dogs suspectedly rabid.* Of these people, 100 were bitten before December 15th, and the remainder subsequently; yet all, except one, had remained in good health, even the operation of inoculation being unaccompanied by any inconvenience. The case which died was that of a child severely bitten by a rabid sheep-dog on October 3rd, but who was not brought to Pasteur until thirty-seven days afterwards, when inoculation was practised, though against Pasteur's inclination, as he only too correctly surmised that the delay was too protracted. The child died of hydrophobia. The inoculated persons have come from all parts of Europe, and some from America.

It is now proposed to establish a Pasteur Institute in Paris, for the reception of people who have been bitten by rabid animals, where they will be protectively inoculated against the disease.

It is difficult to arrive at a satisfactory interpretation of the method by which Pasteur renders animals and mankind impregnable to the infection of rabies. He is himself of opinion that the facts are not in accord with the notion that contact with dry air gradually diminishes the intensity of the virus in the spinal marrow until it becomes null; so that the method is based on the employment of a virus at first almost inert, and then increasing in potency. The lengthened duration of the latent stage is not due to enfeeblement of the intensity of the virus, but to its diminution in quantity. So that the immunity might be given by inoculating very small, but daily increasing, doses of the same very active poison.

Another explanation he gives, which appears rather strange, but which agrees with certain results observed in studying micro-organisms, and especially the pathogenic, or disease-producing,

* It is perhaps needless to add that the list of patients sent to Mons. Pasteur increases day by day.—Edit.

microbes. Many of these appear to produce, in their cultivating media, matters which possess the property of hindering their own development. Since 1880, Pasteur had been making researches with the view to establish the fact that the fowl-cholera microbe produces its own poison. He has not yet been able to demonstrate the presence of this matter, but he thinks this can be done by using pure carbonic acid gas. The microbe of swine-plague is cultivable in very diverse kinds of infusions, but its increase in weight is so small, and it is so promptly arrested in its proportion, that it does seem that something is elaborated which stops the growth of the organism, whether cultivated in air or in a vacuum. Professor Raulin, in 1870, announced that the mould—*Aspergillus niger*, when vegetating, develops a substance which partially checks its growth, should the nutritive medium not contain iron salts. It may be, therefore, that the rabific virus contains two distinct substances—one being living and capable of multiplying in the nervous system; and the other, non-vital, having the faculty, when in certain proportion, of interrupting the development of the first.

Thus far I have attempted to trace, though feebly, I fear, the progress made by Pasteur, in his noble endeavour to benefit mankind, by devoting his body and mind incessantly to the study of part of a subsection of the organic world, consisting of organisms which, if infinitely mean in their dimensions, are yet amazingly powerful in their action, and of which little, if anything, was known before his advent. The record of his labours, and the success attending them, should be sufficient to stamp him as one of the great benefactors of the human race; his last achievement as far transcending his previous victories, as his whole work must raise him above those, whose one or two discoveries have conferred immortality upon them. Though quietly and unostentatiously toiling for so many years without seeking for fame or reward, overtaxing health and strength, and incurring grave risks of infection from the poisons which he sought to render tractable and useful, as well as encountering disparagement, incredulity, and opposition, he has nevertheless risen to the highest pinnacle of greatness, and France has generously acknowledged how much he has added to her honour and her well-being.

Professor Huxley, some time ago, in alluding to the benefits which have resulted from his labours, and pointing out the manner in which he has opened out such sources of wealth to industry and agriculture in his own country alone, has said: "Pasteur's discoveries suffice, of themselves, to cover the indemnity of five milliards of francs paid by France to Germany." But his discoveries in contagious diseases and their prevention,

cannot be estimated at a money value; nor can the effect of these discoveries on present and future investigators be overlooked. The possibilities which his researches have thrown open, to my mind, are amazing, and have surprised Pasteur himself.

His discoveries he looked upon as only a mere beginning, and he has often said, "You will see how all this will grow in time. Would that my life were longer!" And all friends of science and humanity must heartily echo the wish.

Some may be inclined to ask what practical value Pasteur's "Vaccination" is likely to have in dealing with contagious diseases; and others may deny that the method will ever possess advantages over the ordinary methods of combating them. This question of practical utility is worthy of consideration, and until his vaccination has been tried extensively for some time, it would be somewhat imprudent to hazard an opinion one way or the other. We have no evidence that, in the enfeebling or attenuating of the virus of these disorders, the germs are positively destroyed. On the contrary, we know they are sufficiently active to remove from the blood and tissues the pabulum which would serve for the multiplication of another generation of their kind, or produce in the body they invade the hypothetical inhibitory substance which will act as a poison to them. And we also know that weakened germs can regain their pristine virulency when placed in favourable conditions. Better by far, then, to utterly destroy the germs, even should this necessitate the destruction of the animals whose bodies they have taken possession of for their breeding ground, than keep them alive in a semi-latent condition, from which they may start with all their lethal vigour whenever circumstances allow them.

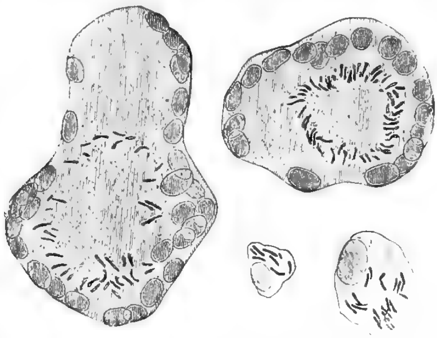
The apparently barbarous and unscientific "stamping-out" process has this to commend it, that, if thoroughly carried through, it exterminates the germs, as pulling up and burning noxious weeds before they seed clears the land of them. Therefore, in special cases, as where the disease is not very widely spread, and can be eradicated in this way without heavy loss, "stamping-out" by slaughter—repulsive though it always must be—must be preferable to protective inoculation. But it is evident that such a summary method can never be attempted with mankind; and even with animals, under certain conditions, it would be futile. Take such a malarious malady as the South African horse-sickness, for example, which is indigenous to the *Vleys*, or low-lying valleys, and is due to germs in the water or on the moist herbage, which horses eat at a certain season. Such a disorder cannot be extinguished by destroying the sick horses, as the germs infest the soil, the grass, the water, and perhaps the very air is laden with them at certain hours during

the sickly period of the year. And so with other animal disorders of a contagious character, which are widespread, and so treacherous in their infectiveness and insidious in their progress, that the skill and vigilance of man cannot grapple with them. For these the benefits of protective inoculation may be invoked.

Daily the disciples of Pasteur enlarge the territory in which he was the first to break ground, and reap such a marvellous harvest; and the special microbe of each specific disease of man and beast is being revealed, and in some instances cultivated so as to serve as a defence against its uncultivated congener.

One of the most treacherous and invasive, as well as destructive diseases of cattle, which is sapping the vitality of the best breeds, and which is communicable from the bovine to some other species—most probably also to mankind—through consuming infective milk and flesh, is Tuberculosis, or "Consumption." The microbe, or bacillus, of this infectious scourge was first clearly demonstrated by Koch, though previously Toussaint had found a micro-organism somewhat unlike this, but which may have been another form of the bacillus. He also succeeded in producing a culture fluid, which, when inoculated,

Fig. 13.—*From the Tuberculous Deposit in the Lung of a Cow.*



Showing two large or "giant-cells," and two small cells, containing the germs or bacilli of Tuberculosis. Magnified 700 times.—*Klein.*

caused the disease. Gerlach, of the Berlin Veterinary School, had also before this proved the ready transmissibility of tuberculosis, being corroborated by Toussaint, Chauveau, and others. But, unfortunately, this bacillus has not yet been made subservient to man in affording protection from consumption.

The bacillus of Glanders has been discovered and cultivated by Schutz and Löffler, but it does not yet ensure protection from that malignant pest of horses.

Micro-organisms (micrococci) were observed in Cattle-plague

by Klebs, in 1872, and by Semmer, of the Dorpat Veterinary School, two years later. In 1882, the latter cultivated this microbe, and found it grew abundantly. A calf inoculated with the culture died in seven days from rinderpest. When transferred, the cultures gradually become weaker, and sheep inoculated with them do not perish, but are rendered refractory to infection. Semmer has also discovered the microbe of dog Distemper.

Fig. 14.—*Pus of a Pulmonary Abscess in a Horse dead of Glanders.*

1. The nuclei of pus cells. 2. The glanders-bacilli.
Magnifying power, 700.—*Klein.*

Lustig, of the Hanover School, has discovered a bacillus in horse Influenza, which he has grown and inoculated. The same authority has also described, and experimented with, the micro-organism of Lung-plague, which had already been discovered by two Professors at Louvain University. Not long ago the Agricultural Society of Pavia, alarmed by the havoc wrought by Foot-and-mouth disease, appointed a Committee to study its progress and nature. The Secretary was Dr. Nosotti, who verified the observation of the veterinary professor, Rivolta, that the disorder was due to a microbe—the *Micrococcus aphtosus*—inoculation of which always gave rise to the disease, which could be rendered benignant by cultivation of the germ. And still more recently, Dr. Klein has published a short paper on this organism. On feeding sheep with the twentieth-generation cultivation, he produced the disease in them.

I might further allude to similar discoveries, but this reference will testify to the immense impetus Pasteur has given to the study of these so-called "germs,"—a study which has become so important as to constitute a section of biology, under the designation of Bacteriology.

There can be no doubt that the more we are acquainted with the nature, mode of development, vitality, and special peculiarities of these microscopic entities, so the better we shall be able to destroy them, utilise them, resist their lethal influence, or avoid them. When we know, for instance, that septic germs

are, in all probability, the active agents in the production of "navel ill" in lambs, "joint ill" in foals, and "heaves" (inflammation of the womb) in ewes, we can readily imagine how these serious conditions may be prevented by the exercise of a little care. One cause of abortion in cows is, with great likelihood, laid to the charge of germs; and the so-called blood-poisoning, which so often follows surgical operations, injuries, and parturition (puerperal or parturient fever), is due to the malevolent living atoms, which seem to be omnipresent, and are ever eager to commence their natural course of proliferation. To the surgeon, to the veterinary surgeon, and also to the agriculturist who breeds, rears, or employs animals, this knowledge is of great moment. To the latter, also, it is of additional importance, seeing that the germs play a lively *rôle* in the dairy, in ensilage, in nitrification of soils, in the improvement or deterioration of food for animals, and in many other ways, which, until Pasteur began to throw light on them, were never suspected.

Errors are almost inevitable in such a study as this of Bacteriology, which is so difficult and intricate, and demands an excess of patience and powers of observation that are given to few. For it must be remembered that each of these micro-organisms has a clearly-defined part to play in the programme of Nature; each has a chemical and distinct individuality, though in some instances it may be within a narrow compass, and though the differential anatomical or structural peculiarities of each may be most difficult, if not impossible in some cases, to find out. They each have their affinities or predilections for nutriment, locality—whether in or out of the body—and their special mode of finding access to a suitable *habitat* and development there. Only with the most laborious care, and special management and processes, can some of them be rendered visible.

We may therefore conceive something of the magnitude of the task which investigators in this wide and only partially-explored region have to encounter, especially when we learn that as many as 50,000 of some of these bodies would be required to make up the bulk of a small cheese-mite. To have accomplished so much and so thoroughly in this direction—to have been the pioneer in investigations which have already revolutionised medical doctrine, and greatly added to our knowledge of natural phenomena—to have effected large economies in important industries and agricultural operations;—but, above all, to have given us the means of averting or resisting the most baneful and pestilent diseases, is the honour to which Pasteur is entitled, and which will be gratefully accorded him now, and in still larger measure hereafter.

IV.—*Report on the Dairy and Stock-Farm Prize Competition,* 1885. By J. Chalmers Morton, Editor of the 'Agricultural Gazette.'

The Judges had three classes of farms submitted to their inspection:—First, "dairy farms in which the management and cultivation are devoted to the production of milk, butter, and cheese," arranged in two divisions—Class 3, of 100 acres and upwards, and Class 4 of less than 100 but more than 30 acres: 2nd, stock-breeding farms, "where the management is principally directed to the breeding and rearing of live-stock—cattle, sheep, and pigs"—including Class 5, of 100 acres and upwards, and Class 6, under 100 and more than 30 acres: and 3rd, Class 7, "farms of not more than 40 acres where the principal part of the labour is contributed by the farmer's own family." In pursuance of their instructions, they inspected all the farms, 22 in number, which were submitted to them under this classification, on three separate occasions, in November, April, and July respectively—spending about a fortnight on each occasion, walking over the land each time and taking full notes of the equipment of the homestead and of the fields, also of the character of the stock, and of the field and dairy management, and of the quality and quantity of the produce of all kinds.

In November we could observe the character of the soil and of the stock, we examined the buildings and implements, and we learned all the particulars of income and outgoings—costs, and expenditure of every kind. In April the field-work was generally forward, potatoes planted, preparations made for green-crops, and the condition of the land could be observed. The earlier make of cheese, some of it already sold, was generally fit for inspection on the floor of the cheese-room. In July the dairy-work was in full swing, corn-crops were in ear, potatoes covered the ground, hay-making was in progress or completed, turnips and other green-crops were in various stages of forwardness.

It is now proposed to give the substance of the notes taken on these occasions, together with the information which was obtained by a somewhat elaborate circular inquiry addressed to the tenants of all these farms. We are not particularly anxious here to justify our awards; but, having made them to the best of our judgment and ability, we wish to point out such particulars of the management and its results as may be of interest to agricultural readers. The somewhat arbitrary definition of the several classes of farms submitted to us resulted nevertheless in a satisfactory uniformity among those in each. The farms in most

cases were fairly comparable: the last-named class, where the personal labour of the tenant was expected to be a large share of the whole outlay, being virtually the only exception. There was but one entry in Class 6, which, however, we thought deserving of the prize: but in all the other classes the entries were sufficiently numerous to make the work of inspection extremely interesting, and the award of the prizes often difficult. In Class 7, where the entries were not so perfectly comparable with each other as in the other cases, one at least was a market-garden almost exclusively, but the other two were small farms cultivated very much as in the other classes for stock and dairy produce as well as for the corn and potato produce of the arable land. In all the other classes the tenants were distinctly tenant farmers, and a very admirable body of farm tenantry they are; men of whom any estate anywhere might be proud. Nor were the farms in each class by itself so widely scattered, or placed under such varying circumstances, that a fair comparison was hard to make. The largest class of all—dairy farms over 100 acres—were, with two exceptions, within a day's ride of each other; and generally there was no such difference of either soil or climate in the examples submitted under every separate class as to make any of them specially exceptional. The three stock-breeding farms in Class 5 lie all in North Lancashire—one on the low level of the Fylde, another on the rolling country below the hills near Lancaster, the third beyond Barrow, extending from the upland moor on the south-eastern side of the bay to almost the level of the tide. The dairy farms between 30 and 100 acres are several of them near Preston, others in Cheshire; the large class of dairy farms over 100 acres are nearly all in Cheshire or closely adjoining: and in no case was there any difficulty in making our award, except that which arises from equality of merit.

After this statement at once of the problem submitted to the Judges, and of the pains they took in the solution of it, it may be convenient to give their awards as follows:—

In Class 3—Dairy Farms of 100 acres and upwards, where the management is directed to the production of milk, butter or cheese—there are seven entries, the majority of which, lying in a district where farm competitions have long been annually instituted, are worthy of high commendation, several of them being of nearly equal merit. The Judges award the first prize to Mr. John Lea, of Stapleford Hall, Tarvin, and the second prize to Mr. Thomas Parton, of Chorlton, Nantwich. They highly commend Mr. Thomas Fearnall, of Royton, near Wrexham; Mr. Cyrus Lea, of Duddon Hall, Tarporley; and Mr. Joseph Robinson, of Lee Green Hall, Middlewich. They award the reserve number in this class to Mr. Thomas Fearnall, for the general dairy management of his farm, and especially for the uniform excellence of the cheese and butter made on it. They very highly commend him for the example (of the highest professional value) which is here presented of a large

family and household unitedly engaged in the work of an unusually important and successful dairy business. And they recommend that the highest mark of approval at the disposal of the Council be awarded to his eldest daughter now at home, on whom (since the death of her mother) the care and responsibility of the dairy, and the household, and a large young family, have almost entirely rested.

In Class 4—Dairy Farms above 30 and under 100 acres—there are eight entries. The Judges award the first prize to Mr. Edward G. Hothersall, of Lightfoot House, Broughton, near Preston; and the second prize to Mr. Jonathan Fowler, of Free Bull Farm, Ashton-on-Ribble; and they highly commend Mr. Thomas Lowe, of Malpas—all of these farms being remarkable for the excellence of their dairy herds, and for the care and judgment displayed in their management and selection.

In Class 5—Stock-breeding Farms of 100 acres and upwards, where the management is principally directed to the breeding and rearing of live-stock, cattle, sheep, horses, and pigs—there are three entries. The Judges award the first prize to Mr. George Ashburner, of Low Hall, Kirby-in-Furness; and the second prize to Mr. James Tunstall, of St. Michael's-on-Wyre, Garstang; and they commend Mr. Edward Newhouse, of Slyne, near Lancaster. They add that in no instance in this Class does the field management come up to the standard of what is seen in Classes 3 and 4. The Judges have therefore been guided in their decision entirely by the character of the live-stock on the several farms.

In Class 6—Stock-breeding Farms over 30 acres and under 100 acres in extent—there is only one entry, that of Mr. John Cottam, of Wellhouse Farm, Scotforth, Lancaster. The Judges award to him the first prize, to which he is entitled, especially by the excellence and good management of his live-stock.

In Class 7—Farms of not more than 40 acres, where the principal part of the labour is contributed by the farmer's own family—there are three entries. The Judges award the first prize to Mr. William Loxham, of Leyland, near Preston; the second prize to Mrs. Margaret Park, of Cropper Farm, Little Marton, Blackpool; and the third prize to Mr. Joseph Gibbins, of Culcheth, near Warrington.

The Judges also award certificates, "for distinguished merit in the discharge of their duties" on the farms inspected, to William Vernon, in the employment of Mr. John Lea, of Stapleford Hall, who has been herdsman and principal labourer on the Stapleford Hall Farm, in the occupation of Mr. John Lea, and his predecessor, Mr. William Palin, for nearly half a century; to Thomas Sproston, 24 years herdsman on the farm of Mr. Thomas Parton, at Chorlton, Nantwich; and to Thomas Penk, 18 years principal labourer on the farm of Mr. Thomas Fearnall, of Royton, near Wrexham; also to Joseph Lloyd, Duddon Hall, near Tarvin, on the farm of Mr. Cyrus Lea.

In making these awards we were careful to observe all the conditions which the Society imposed; viz., to consider—(1) the general management, with a view to profit; (2) the productiveness of the crops; (3) the quality and suitability of the live-stock; (4) the management of the grass land; (5) the state of the gates, fences, roads, and general neatness; (6) the mode of book-keeping followed; and (7) the management of the dairy and the dairy produce.

The principal lesson, probably, which has been learned from the inspection on the whole, is the enormous extent to which

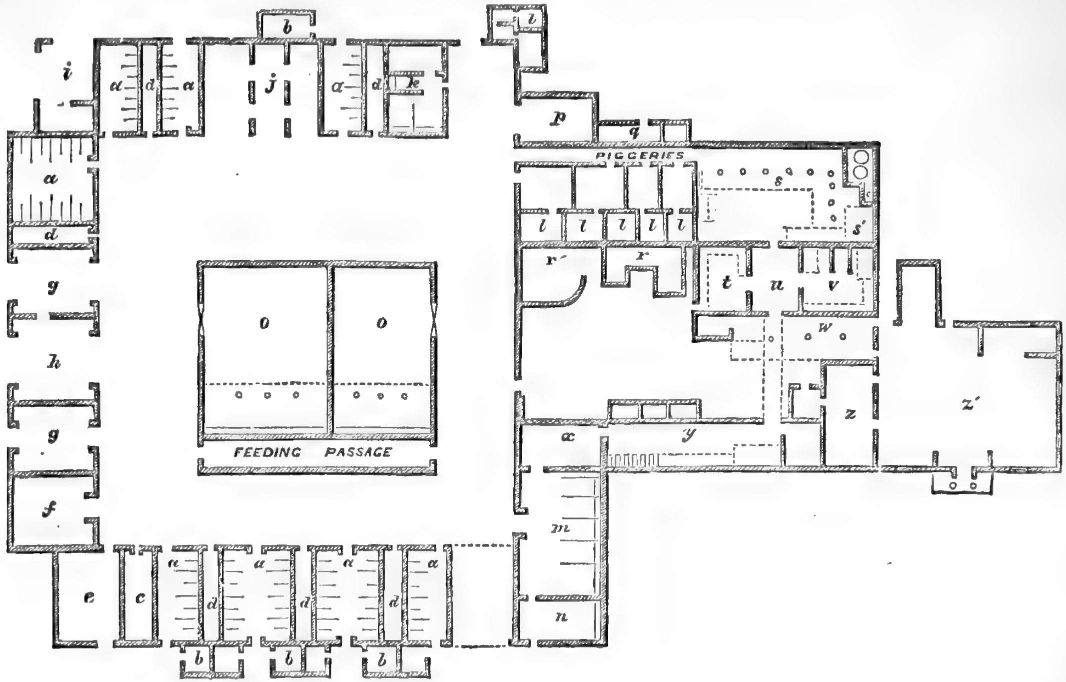
the fertility of most of these farms has been created by their tenants; the extent to which, in many instances, even the equipment of the land has been due to their outlay; roads, fences, drains, water-supply, even buildings, having been executed and erected with little aid from the owners. And the list of improvements of these kinds, of which the tenant himself has borne both the labour and the cost, is always the first claim which he puts forward to the favourable consideration of the Judges. It may be thought from this, especially in a district where the farm-prize system has had a longer existence than anywhere else in the country, that the system of farm prizes is an institution altogether in favour of landowners; and it is certain that where prizes have thus been offered for successive generations, the *corpus* of the estate, as well as its mere surface management, has been generally benefited. And the whole institution, administered generally by land-agents as judges, may thus, perhaps, be considered to be a shrewdly designed agency in the interest of the owner. Not so! We are bound to say that our work has been done with no prejudice of this or any other kind to begin with, and no instruction subsequently to consider the interest of the estate in our awards. The general management, with a view to profit, is indeed the first item in our instructions, and the keynote to the whole of them. And it is a significant fact, that our awards have come to those tenants who, while they have most benefited the property, have at the same time done best for themselves.

Beyond this general impression a number of facts stand out on a review of our inspection which may be referred to in the outset: among them are the extraordinary enterprise, energy, and industry shown on Mr. Hothersall's First Prize small Dairy Farm near Preston; the wealth of provision for live stock, admirable grass and clover, and extraordinary promise of green-crops shown on Mr. Robinson's farm near Middlewich; the wonderful crop of oats on Mr. Cyrus Lea's farm near Tarvin, one of the finest things ever seen on arable land; the completeness and neatness of the homestead, the general excellence of all the crops, and the admirable condition, as a whole, of the First Prize Farm at Stapleford, the profitableness there, too, of the large garden attached to the house; the admirable and laborious management of the First Prize Small Farm occupied by Mr. Loxham, near Leyland; the praiseworthy house and dairy management on Mr. Fearnall's farm near Wrexham, so greatly to the credit of his daughter. And there are points worthy of notice on the other farms which well deserve a record here. The capital stock on Mr. Ashburner's farm, and on that of Mr. Tunstall, and the quality and quantity of all kinds of stock on Mr.

Newhouse's farm, all these being in the same class; the excellent management of Mr. Parton, at Chorlton, which received the Second Prize in his class, where good stock and good dairy management and general excellence of crops well deserved the highest commendation we could give; the capital herd of cows and general good management of Mr. J. Fowler, who received the Second Prize in the same class with Mr. Hothersall; the excellent stock and cropping too on Mr. Lowe's farm near Malpas, who came third in that very remarkable class—the stock on all of these being maintained more by purchase than by home-breeding:—All these deserve a record; and still more does the impression made on us in all these cases of the hearty cordiality with which the Judges were in every case received; and the admirable character for energy, good feeling, intelligence, and enterprise of all whose farms we visited. With these preliminary remarks we proceed to describe the prize farms particularly, the others more generally.

Class 3 included Dairy Farms over 100 acres in extent. There were 7 entries in this class, and the awards have been already announced. The First Prize was awarded to Mr. John Lea's farm, Stapleford Hall, near Tarvin, to which a similar place was given in the farm competition at Liverpool in 1877. This farm of 288 acres, 104 being arable, lies in the parish of Tarvin, about six miles east of Chester, and is the property of the Rev. Canon F. Hayhurst, of Davenham Rectory, Northwich. It lies partly on the marl of the new red sandstone and partly on the gravel-beds covering the same; and the soil varies accordingly between a light, sometimes gravelly, and a heavy loam. The very substantial and excellent farmhouse has more than two acres of garden-ground attached to it, and it adjoins the homestead, which is arranged in the usual form of a square, as represented in the annexed engraving, which was used in this Journal seven years ago and may be reproduced now. It will be understood that the reader looking at it is facing the south, that the central square building, represented as including a shed and yard, which it was then proposed to be erected, has not been provided, but that the square is only a walled uncovered inclosure for manure. It must also be understood that the land falls towards the south, and that some deep shedding with yards has been added to the old premises on the southern side of the present square; also that on the north side are three large Dutch barns, two of which have been erected at the tenant's cost; and that on low-lying ground on the east side is an inclosure on which potatoes and other green-crops are pitted. The whole

Fig. 1.—*Plan of Mr. Lea's Homestead, Stapleford Hall, Chester.*



a, a, a. Cows.
b. Calves.
c. Bulls' house.
d. Fodder.
e. Roots.
f. Loose-box.
g. Mixing-room.
h. Straw.
i. Implements.
j. Cart-shed.
k. Saddle-room and Nag-stable.
l, l. Pigsties.
m. Cart-stable.
n. Hospital.
o, o. Open Yard.
p. Coach-house.
q. Tools.
r. Poultry; *r'*. Coals.
s. Shed; *s'*. Whey.
t. Milk-house.
u. Churn-room.
v. Dairy.
w. Shedding.
x. Stores.
y. Drying-room.
z'. House; *z*. Pantry.

[In addition to the spaces *d* between the cow-byres, the "tallet," or second floor, over the whole range of cow-houses, is filled with hay, straw, and corn. The cheese-room occupies the second floor, over *x* and *y*, which are severally the Store-room and Drying-room belonging to the House.]

premises on all our visits always presented the appearance of constant cleanliness and good management.

Mr. Lea now holds Stapleford Hall Farm on a yearly tenancy; he has occupied it for seventeen years, and during that time he has effected many improvements both in the land and homestead. In particular, he has eradicated more than two miles of old fences, and made a mile and a half of new fences, at a cost of 122*l.* He has spent 60*l.* in filling up old marl-pits and levelling the land, 35*l.* in making and levelling the stock-yard, 30*l.* in making roads, 160*l.* in erecting two Dutch hay-barns, each standing on 25 yards by 8 yards, and 16 feet high; 63*l.* in walling and iron fencing; 315*l.* in draining and ditching, the landlord finding pipes; 780*l.* in bones, besides a quantity of guano and other manures; upwards of 1600*l.* in all, in what may nearly all be called landlord's improvements. Though he has thus done a great deal for the good of the estate, certainly the accounts he has rendered to us show that he has also done well for himself.

The arable land was covered on our last visit with admirable crops of wheat and oats, swedes and potatoes; and a great crop of clover had been saved and housed. It was everywhere clean, and in good heart. The meadows also were full of produce, which was being cut, partly by machine, and, where too heavy or too awkward for that, by hand; there costing 5*s.* an acre. The pastures were full of clover; and it is noteworthy as showing what a tenant, especially in this county, thinks of the pasture-land as being to his own credit, that here, and in every other case, it was insisted that we should walk or drive zigzag over the whole surface of it, just as we needed to do, in order to realise the quality of the potato-crop, the swedes, the oats, or the wheat. Every square yard of it was claimed as due to the tenant's own management. A man generally walks once, or it may be twice, across a grass-field, in order to realise its character, but zigzag over the whole of an arable crop, in order to be sure of a correct impression. Here, however, as on other farms, every part of the pasture-fields, as of the arable, was claimed as due in great measure to artificial management.

The stock upon the farm included 91 cows of a Shorthorn type—large-framed, useful cattle; 20 of them two-year-old heifers. A certain number had come to the pail late in the year for the provision of winter milk for sale in Liverpool. On the previous year, when 85 cows were milked, 18 tons of cheese had been sold at an average price of 73*s.* 6*d.* per 120 lbs.; 1944 lbs. of butter had been sold at an average price of 1*s.* 3*d.*; 4905 gallons of milk had been sold at an average price of 11*d.* a gallon; 68 fat hogs had been sold at an average price of

6*l.* 2*s.* 6*d.*; and 23 young pigs at 1*l.* a-piece; and 50 calves had fetched 102*l.* 10*s.* The whole proceeds of the dairy thus amounted to 2284*l.* 15*s.* 9*d.*, or close on 27*l.* a-piece over the 85 cows. It must be noted, however, that there had been an expenditure of 240*l.* 18*s.* 9*d.* on linseed and cotton-cake, 54*l.* 17*s.* on bran, 203*l.* 3*s.* 9*d.* on India meal, and 85*l.* on brewers' grains; also about 60*l.* worth of wheat and oats home-grown had been consumed. The total here amounts, therefore, to 644*l.* on purchased food. One calf and 4 pigs had been bought at the cost of 10*l.* 5*s.*; and putting this all down in the account, the balance per cow is reduced about 8*l.*, or to somewhere near 19*l.* per cow. It must, however, be noted that among the sales of the year were 19 fat cattle for 408*l.* 10*s.*, and no doubt a portion of the outlay for feeding-stuff was consumed by them. But this item of 408*l.* 10*s.* may be claimed as properly belonging to the dairy-stock—which is maintained, and even increased, during the year, in spite of these sales. And it is perhaps safer to leave the enormous yield per cow thus realised on a well-managed dairy-farm uncertainly reported, rather than pretend to a detailed accuracy, for which we may have hardly got the whole materials.

The labour of the whole 288 acres is done by 2 cowmen, receiving 18*l.* a-piece and their board, 2 carters, receiving 15*l.* a-piece and their board, 2 other men at 15*s.* per week, one old man at 12*s.* a week; also one dairy-woman at 16*l.*, 2 girls at 10*l.* and 4*l.*, 2 boys at 9*l.* and 8*l.* respectively, all these being boarded in the house. And besides this, there was an extra expenditure of 17*l.* 10*s.* during the hay-harvest, 10*l.* 9*s.* 6*d.* during the corn-harvest, and 30*l.* during the potato-harvest; and, making a fair allowance for the cost of boarding so many in the house, it appears that the total labour-bill comes to about 410*l.*, or close on 32*s.* an acre, which seems to be quite as heavy a cost as, considering the proportion of the grass-land, might have been expected.

The returns from the arable land were 820 measures of wheat (75 lbs. each) at 6*s.* 6*d.*, 266*l.* 10*s.*; 2000 measures of oats (46 lbs. each) at 4*s.*, 400*l.*; 600 loads of potatoes ($2\frac{1}{4}$ cwt.) at 7*s.*, 560*l.*; 14 tons of hay at 4*l.* 15*s.*, 66*l.* 10*s.*; 30 tons of oat-straw at 2*l.*, 60*l.*; 19 tons of wheat-straw at 2*l.* 15*s.*, 52*l.* 5*s.* There was also a produce of not less than 100*l.* from fruit, vegetables, and young trees, out of the garden, and 52*l.* from poultry. The other costs of the farm have been —rent, 600*l.*; tithe, 61*l.* 15*s.*; poor's rates, including roads, 34*l.* 18*s.* 9*d.*—in all, 696*l.* 14*s.* 9*d.*, or about 48*s.* an acre upon the whole. The manure bought last year included $19\frac{1}{2}$ tons of bone-dust, equal to 122*l.*, and a ton of guano, costing 13*l.* 10*s.*

The reader may strike a balance if he pleases. He will find that during the year in question the tenant's profit must have been almost incredibly large. The fall in the price of cheese and of grain has, of course, greatly reduced his returns this year; but he informed us on our second visit that his earliest make of cheese had been sold for 68*s.* per cwt. It is sold to a co-operative store in Manchester, and Mr. Lea thus gets very nearly the price which the consumer gives. His cheese, which we had the opportunity of examining on several occasions, was of fair, but not altogether uniform, quality. This was especially perceptible on our last visit in July. The variation was attributed to an unavoidable interruption of home superintendence at one period. The butter which we then examined was admirably made, and of excellent quality. The quantity taken varies from ½ a lb. to 1 lb. weekly per cow, according to the season of the year. In 1884, however, only 1944 lbs. of butter were reported from 85 cows.

The horse labour of the farm is done by six very good farm-horses, two of them mares, and there was a very useful colt from one of them. The implements included a lurry, four carts, one straw-cart, one liquid-manure cart, one milk-cart, two wheeled drags, one corn-drill, one double-row turnip-drill, one clover-seed drill, one Cambridge-roller, one flat roller, three two-horse ploughs, one one-horse plough, two ridging-ploughs, one four-furrow seed-coverer, one cultivator, four sets of seed-harrows, one set of chain-harrows, one set of drag-harrows, one pair of drill-harrows, one horse-hoe, one mowing-machine, one reaping-machine, one hay-tedding machine, two horse-rakes.

We turn now once more to the farm, which lies almost entirely on the south side of the premises—with, however, two outlying pieces, north and south-west, the latter wholly pasture, in three fields about 27 acres in all, the former wholly arable, in two fields of 11 and 17 acres respectively. The land, as seen in April, was clean and in good order; the wheat-plant good, the oats coming through, potato-planting finished, and work generally forward in preparation for green crop. In July we found a very heavy and even crop of oats, Canadian Polands, a very fine crop of Scholey's Square-head wheat, and a splendid crop of Webb's Kinver Giant wheat. The pastures were all full of food, although heavily stocked. A heavy crop of grass was being cut, and a good crop of clover-hay had been carried. Seven acres of swedes were already nearly covering the ground—a perfectly even plant; and the potatoes (Magnums) were very forward—a clean, uniform, and most promising crop. The rotation followed on the arable land is (1) oats; (2) green crop, viz., potatoes and swedes; (3) wheat; (4) oats; and (5) clover. We may take the

history of one or two of the fields as examples of the management. Walking round the farm, and hearing the history of each field, we get the impression that every separate piece has been carefully and energetically managed. A field of $13\frac{1}{2}$ acres, full of grass, had been laid down three years before, after having been ploughed for five years out of old pasture. It was boned on the clover-root, and again, in the autumn of 1884, mown twice the first year, and subsequently grazed, and now looks like good old pasture. No. 21, an old permanent pasture, had been boned in 1884 with 8 cwt. per acre—drained by the tenant; drain-ends made up with blue bricks, in perfect order; fence at the plantation end taken out by the tenant; several marl-pits filled up, new fence planted (double) and well protected.

It will be understood, without going farther into detail, that here is a farm carefully and successfully cultivated, well stocked, yielding profit to landlord and tenant alike, and deserving, in our opinion, the first place on the list, good as many of the other competitors are. Mention must also be made of the extraordinary garden attached to Mr. Lea's house, from which plants and vegetables, asparagus, and rhubarb and early potatoes, young fruit-trees, and fruit (damsons, apples, gooseberries), to the extent sometimes of 100*l.* a year, are sold.

We were instructed to take notice of any instances of praiseworthy agricultural labourers on the farms we visited, to whom the Certificate of the Society might be awarded. We found on Mr. John Lea's farm that William Vernon had been a labourer there for over fifty years. He is now seventy-four years of age; he has always done most of the stacking and thatching on the farm, and is a very good workman at any farm-work. He was forty years in a club at Tarvin, till it was broken up, and is now earning 12*s.* a week—a worthy man, who has done his duty in the station to which he belongs—and he well deserves the distinction which the Society offers. He has a cottage and $2\frac{1}{2}$ acres of land.

Mr. Lea has two labourers who have crofts with their cottages —one has 4 acres all grass, keeping two milking cows, and rearing a heifer each year, and sometimes two—of course with the aid of many months hired feed elsewhere during the summer, Of the other crofter-holding, whose tenant received the above award for long and faithful service, we may give a more detailed account. He holds $2\frac{1}{2}$ acres, including his garden, at a yearly rent of 10*l.* 10*s.* He has 2 acres in grass, and a rood in garden ground. Last year he kept one cow, and made 15*l.* 10*s.* by butter. He also sold a heifer for 7*l.* 10*s.*, and pigs for 8*l.* His garden yields him an independent profit, and he keeps some poultry; and he considers that his labour, on the whole, is equal

to three full weeks of his own time in the year. His cow-club insurance costs 8*s.* Putting his heifer out to lay costs 30*s.* He buys food for cow and pigs to the amount of 10*l.* 10*s.* yearly. If the charges be put together they will be found to amount to 22*l.* 18*s.* a year, and his receipts come to 31*l.* To the former side of the account must be added that he thus has house-rent free, and a certain amount of profit from garden and from poultry. To the other side of the account it must be added, that the three weeks' wages of the man must be worth at least 2*l.*, and that the labour of the wife is considerable; and that some extra expense must be added for maintenance of the pig-stock. It is plain, however, that the whole household benefit largely by the interest and occupation, and, so far as the boys and girls are concerned, by the education involved. And as to the mere balance of the account, those who are thrifty can thus accumulate sundry small savings and returns, which, under the crofter system, become possible. The system is largely prevalent in Cheshire—the crofts are generally let direct from the owner, not through the farmer. Lord Tollemache has been good enough to give me the statistics of his large property in the county; and he has no fewer than 250 crofter tenants, who hold directly from himself, and are thus made not only more thrifty, more prosperous, happier, and more contented in themselves and families, but really more serviceable and most trustworthy, and, in short, better servants on the farms to which they are attached. It is a capital feature in any great agricultural system, of which Cheshire thus gives an example to other counties.

The second prize in this class we have awarded to Mr. Thomas Parton, of Chorlton Farm, in the parish of Weston, about 4 miles from Crewe. There are here 166 acres, of which 84 are in permanent grass, and 82 arable, the property of Sir H. D. Broughton, Bart. The farm is let from year to year at a rent of 287*l.*, in addition to which the tithe amounts to 18*l.* 6*s.* 6*d.*; land-tax, 6*l.* 9*s.* 2*d.*; poor's rate, 15*l.* 4*s.* 1*d.*; school rate, 1*l.* 16*s.* 8*d.*; other rates, 4*l.*; or 333*l.* 6*s.* 5*d.* in all—almost exactly 2*l.* an acre. The rent was raised 13*s.* an acre when Mr. Parton succeeded to it on the death of his father, thirteen years ago, and no reduction has been either made or asked for since that time. The arable land is generally a light soil, sometimes gravelly, the rest being generally a heavy soil in pasture. The grass-land has been drained—20 acres of it thoroughly, 80 acres partially—at the tenant's sole expense. Mr. Parton has stocked up 8000 yards of old fences, levelling the same, first placing pipes in the ditches that were filled up.

He has also, at the cost of 150*l.*, filled up and levelled old marl-pits; he has planted 2138 yards of new fences, protecting the same, and planting quicks, all at his own cost. He has done all the carting for new buildings—a very extensive range. He has made and painted the gates, and fixed the same—the landlord finding wood. He has erected a Dutch barn, 45 yards by 6 yards, and 19 feet high, at his own cost, except the posts, which were given in the rough. And these improvements have been principally effected within the last eight years. The buildings now are as complete as any tenant could desire; the somewhat homely farm-house being decidedly the most unpretending feature of the whole. The new dairy, with cheese-room overhead, standing on 8 yards by 5, and costing 140*l.*, has been erected by the tenant, to be refunded him at the rate of 50*l.* a year.

On our last visit, a heavy crop of clover had been carried, and was stored in the Dutch barn. The seeds sown had been 4 lbs. of red clover, 3 lbs. of cow-grass, 2 lbs. of alsike, 2 lbs. of white Dutch, 1 lb. of trefoil, and 1 bushel of Italian rye-grass, per acre. It made an admirable mixed hay. The small area of mangolds looked most promising; the swedes, Sutton's purple top, somewhat later than we had seen elsewhere, had been won from repeated attacks of fly. On the first appearance of the fly, a light brush of elder-boughs was drawn over them. This was followed by the turnip-drill with the coulters lifted, the two barrels delivering mixed lime-dust and flour of sulphur. Again the elder-boughs were brushed over the rows, this time watered at each double journey across the field from a water-pot containing paraffin and water. This sufficed, and the plant ultimately came away uninjured, and bid fair, when we saw it, to cover the ground in a fortnight.

The following is a list of the labourers employed:—One waggoner, receiving 15*s.* a week, with 1*l.* at harvest-time; one man at 24*l.* a year, living and boarding in the farm-house; three boys at 5*l.* to 15*l.* a year, also boarding in the house; and three girls at 12*l.*, 10*l.*, and 5*l.* respectively, who also live in the house. Other labour, some of it occasional, amounted in 1884 to 48*l.* 15*s.*; and there was 6*l.* 18*s.* extra spent on the potato harvest. The wages paid amount to 162*l.* 13*s.*, and adding board and cottage hire together, it is probable this represents an outlay of 240*l.* per annum, or about 29*s.* an acre.

Among the other outgoings are those for food and manure purchased; 10 tons of superphosphate were used in 1884, costing 48*l.*; 8 tons of bones, 48*l.* 10*s.*; $2\frac{1}{2}$ tons of guano, 21*l.* 15*s.*; 6 tons of kainite, 13*l.* 16*s.*—or 132*l.* 1*s.* for manures. The food used included 9 quarters of wheat and 100 quarters of

K 2

oats, home grown; 8 tons 4 cwt. of linseed-cake, 65*l.* 8*s.*; 21 tons 15 cwt. of cotton-cake, 163*l.* 16*s.* 8*d.*; 25 quarters of India corn, 31*l.* 5*s.*; 13 quarters of India meal, 20*l.* 3*s.*; and 150 quarters of "thirds," 115*l.* 9*s.* 3*d.*: the whole amounting to 396*l.* 1*s.* 11*d.* for the purchased foods, besides probably 130*l.* worth of home-grown grain, equal to 530*l.* a year in all; or with the manure nearly 4*l.* an acre.

The stock upon the farm at our last visit included 60 cows in milk and 7 feeding cows, 16 two year-old heifers, 24 heifer-calves, 3 bull-calves, 2 bulls, one of which, a massive roan of admirable quality, by the 5th Duke of Wetherby, had won prizes at the Manchester and Liverpool Show, at Preston, at Northwich, Stockport, and elsewhere.

The farm was worked by four horses; and an entire-horse was kept travelling one day in the week during the season, who had taken 60 mares that year at a fee of 35*s.* He had been bought for 65*l.*, and the price of 140*l.* had since been bidden for him. The pig stock included 9 sows and 19 fat pigs; and 50 or 60 fat pigs were sold generally in the course of the year. Thirty sheep were bought for wintering in the pastures.

The sales in the course of the previous year, when 60 cows had been milked, were 360 cheeses, weighing 221 cwt. 1 qr. 19 lbs., sold at 70*s.* to 75*s.* per cwt. for 830*l.* 5*s.* 7*d.* Butter, 2047 lbs., at 1*s.* to 1*s.* 7*d.*, 127*l.* 14*s.*; milk, 6214 gallons, at 8*d.* to 10½*d.*, 255*l.* 19*s.* 9*d.*; 58 fat pigs, averaging 4*l.* 1*s.* 1*d.*, 235*l.* 2*s.* 10*d.*; 2 cows, 16*l.* 5*s.*, 32*l.* 10*s.*; 2 heifers, at 12*l.* 8*s.* 9*d.*, 24*l.* 17*s.* 6*d.*; 10 fat cattle, 22*l.* 14*s.*, 227*l.*; 9 young calves, at 1*l.* 8*s.* 4*d.*, 12*l.* 15*s.*; 9 bull-calves, at 5*l.*, 45*l.*; 11 calves, at 2*l.* 15*s.*, 30*l.* 5*s.*; 40 fat sheep, at 3*l.* 10*s.*, 140*l.*; 36 qrs. of wheat, at 2*l.* 5*s.* 4*d.*, 81*l.* 17*s.* 8*d.*; 70 qrs. of oats, at 1*l.* 12*s.*, 112*l.*; 10 acres of potatoes, 196*l.* 13*s.* 7*d.* The sales of milk, cheese, butter, and pigs amounted thus to 1449*l.* 2*s.* 2*d.*, or 22*l.* 12*s.* 10*d.* per cow over 64 cows in milk, in addition to which 29 calves had been sold for 97*l.* 10*s.* It will be seen that the receipts altogether amounted to 2352*l.* 0*s.* 11*d.*, and that the cost in rents, labour, food purchased, and manures, comes to little more than half of that amount. To the outlay, however, thus specified there should be added purchases of cows, sheep, pigs, and grazing stock to the amount of 208*l.* 10*s.* 6*d.*

We saw the process of cheese-making going on, and, as Mrs. Parton has always obtained a good price for a good quality of cheese, we took down from her the whole story of the manufacture. Some 60 cows are milked, beginning at 5.30 A.M.: ten milkers—men, girls, and boys—are employed. The long rectangular cheese-vat holds 265 gallons, having a false bottom with an arrangement for putting in cold or hot water beneath

the milk. The evening's milk is partly skimmed in the morning, and then passed through the sieve into this vessel and the morning's milk is added as it comes in from the yard. The whole is heated, if heat is required, up to 90° in winter, 84° in summer; a little colouring matter is dropped in, and Danish rennet is then added at the rate of 2 ounces to 40 gallons; and the milk sets in about an hour. It is then cut by a sieve-cutter, with a 2-inch mesh, slowly thrust and lifted alternately. After a short interval of rest the curd is lifted slowly with the hand, and turned over in the vat: this is continued for about fifteen minutes, and then it is again broken with a half-inch mesh and left for 1½ hour longer. The whey is drawn off through a vertical sieve at the side of the vat, and the curd is gathered gradually to one end of the trough, the whey being allowed to escape to the tank, where it stands till the next morning, and is skimmed, the rest going to the pig-vat. The curd is gathered into a sheet and left to drain, being pressed under leverage for a while. The salt added to the curd is about ½ lb. to every 20 lbs. of curd. It is not added until a certain change has passed in the curd by lapse of time —a certain degree of acidity and consequent stringiness being developed before it is put into the mill. It is weighed out in 30 lb. blocks, each of which, after being ground in the mill, is mixed with 20 ounces of salt turned over and over in the tub; and with the hands thereafter packed closely into vats having a tin eke protruding above the level of the wood. It is turned in the evening; next day a certain amount of pressure is applied; and skewers thrust through holes in the vat are used for facilitating the escape of any remaining whey. The second day it is put under full pressure. The cheeses are turned once a day, being three days in the press. When taken out they are bound in cloth, lifted to the cheese-floor, where they are turned every day, and sold when three to four weeks old.

The cows receive 2 lbs. of cotton-cake, 2 lbs. of crushed oats, and 1 lb. of "thirds," daily, when in full milk and at grass. In winter time they are fed on mangolds and swedes, clover, hay, and straw, with cake and meal; the whole of the permanent grass being depastured.

We add the following note from Mr. Parton on the subject of the winter feeding of the cows:—"The cows are usually kept in from Christmas to May, and cows that calve previous to Christmas are not let out at all, except to water. All the oat-straw grown is used for fodder, and the clover is mown twice. I think you computed there was 2 tons 10 cwts. to the acre first time, and the Cheshire Judges thought there was quite 30 cwt. the second mowing. In November the cows get little or no hay,

except those that have calved; in December they get a feed twice daily, and two feeds of cabbage, also roots, tops, &c., with about 5 lbs. of cake and meal. This is the allowance for those that have calved; the others vary, according to the milk they are giving. The cows that are giving no milk get a feed of oat-straw twice daily, with about 20 lbs. of turnips in December; after that time, what oat-straw they will eat, until they calve, when the food is altered to what I have stated previously."

The poultry must be named on Mr. Parton's farm. We saw 34 geese, 25 turkeys, besides about 60 hens. The eggs sold fetched 19*s.* 6*d.* in January, 22*s.* 8*d.* in February; 3*l.* 1*s.* 6*d.* in March; 4*l.* 2*s.*, 5*l.* 19*s.* in April and May; 3*l.* 17*s.* in June; 3*l.* 10*s.* in July; 2*l.* 5*s.* in August; 1*l.* 19*s.* in September; 1*l.* 11*s.* in October; 18*s.* 6*d.* in November. The geese averaged about 30, at 11*s.* each.

The farm premises are now very complete. One long cow-house, 36 feet wide, has three separate cross-gangways, 8 cows standing on either side, holding thus 48 cows; and there are ample premises besides for younger cattle for stables, pigstyes, bull-houses, &c. The implements include, besides the usual equipment of tools for field and barn and feeding-house, a traction-engine and threshing-machine, which are let out on hire.

Here is a case where the ability to maintain a large herd of cattle is largely due to the arable portion of the farm. There is no haymaking off the permanent grass. The whole of the fields in permanent grass or meadow are grazed. They have been drained, thrown together, in some cases refenced, and, to some extent, laid down by the tenant. The liquid manure from the cow-houses drains to a ditch, and is thence carried to a low-lying portion of one of these fields, which get 5 cwt. of bone-dust per acre every third year over the whole estate. The arable land is cultivated generally on a four-course rotation: (1) oats, (2) green crop, (3) wheat and oats, (4) clover. The wheat, Mold's Ennobled wheat, was a fine upstanding crop; the oats, chiefly Poland, an early short-strawed variety, were a fair crop; the clover had been first-rate. The green-crop division included generally 8 to 11 acres of potatoes, 6 acres of Swedish turnips, 3 acres of mangels, and 1 acre of cabbages. Cabbages were also planted among the potatoes, succeeding the early potato-crop, and producing an abundance of useful cow-food.

The herd of cattle—large-framed Shorthorns—were among the finest we saw on any of the competing farms. Mr. Parton was quite justified in entering them for Lord Vernon's prize offered for the best dairy herd, which was won by a competitor in another class.

On this farm, too, we have to record the loyalty and value of a trusted servant. Thomas Sproston, herdsman, has been with Mr. Parton, and his father before him, for twenty-four years, coming to him in early manhood. He lives in the house, being unmarried, and receives 24*l*. and board. He stacks and thatches, attends to the garden, sows manures and seeds, milks regularly, and is head-labourer on the farm. James Dennis may be also named. He has been with Mr. Parton for thirteen years, never leaving a day all that time; he has 15*s*. a week and his house.

The Chorlton farm is a capital example of good Cheshire management—whether the pastures, the plough-land, the homestead, the dairy-produce, or the tenant himself, be considered.

Mr. Fearnall, at Royton, in the parish of Bangor, near Wrexham, occupies one of the largest of the farms in this class. It is the property of Edmund Peel, Esq., Brynypys, Ruabon, and is specially noteworthy for the excellence of its dairy management. The milk of 100 cows, yielding five cheeses daily in the height of the season—some 600 cheeses, generally over twenty tons, per annum—is dealt with by the eldest unmarried daughter of Mr. Fearnall, and her brother. One of Barford and Perkins' 1½-horse-power engines churns and pumps, and materially helps. The milk is received in two large Cluett's vats, holding 280 and 120 gallons respectively. The rennet is home-made. Bits of several vells or skins, some 18 square inches in all, are put to soak in 1½ pint of water and used next day; and a gallon of yesterday's milk, which had been set "always in the same old mug," to quote our notes, and therefore more readily souring, is added with the rennet, and is believed to help and hasten the process. The subsequent steps of that process are very much as they have been already described. We examined a large floor of cheese of the make of 1884, in November of that year, and again the earlier and the later makes of the next year, and the cheese was uniformly rich and good—good and rich without exception, as indeed were the dairy arrangements generally, the only doubtful point being the neighbourhood of the very extensive piggeries, though we saw no sign of injury on that account to either butter, milk, or cheese. A small quantity of cream is taken from the evening's milk, and is churned with the top of the whey, and thus 50 lbs. to 100 lbs. of butter, increasing in quantity in the autumn months, are made weekly. In all 3010 lbs. were sold last year at the average price of 1*s*. per lb. The quantity of cheese sold last year was 22 tons 10 cwt., at 70*s*. per cwt. It is significant that here, where the home-made rennet was used, the best cheese seen on any of the farms inspected was made. The

rennet, says our colleague, Mr. Nuttall, lies at the root of all the good or evil in cheese-making. In the earliest stage of that process lies the secret of failure or success. On the rennet depends the retention or the loosening of the fatty particles in the milk in the outset. It produces a weak or a stable curd, which can be dealt with easily or otherwise thereafter. It holds or it loosens the curd when in its tender stage, preventing it from breaking into small particles and passing off as white whey. It affects the subsequent "cure" most seriously. It affects the taste, and it affects the sale, and it affects the profit. So important is it, that cheese which has started wrong in its first stage can never be rendered perfect afterwards. It is possible, and "even easy," Mr. Nuttall exclaims, "to make good cheese, but you cannot mend it."

Mr. Nuttall recommends home-made rennet. Made from vells, cured from fatting calves which have been fed on milk alone, and kept in pickle till they are wanted, the result in their case is recognizable throughout. The curd must sour, not by added acid, but by the natural fermentation of the sugar of the milk; and the natural home-made rennet is the best security for this. This, carried to its proper stage, is stopped at that stage by the salting. And there the province of the rennet ends. It must be added in the outset at the proper temperature —from 80° Fahr. upwards, and in the proper quantity; and in both of these particulars you must be guided by experience. Mr. Nuttall's two dairy farms, a few miles apart, differ so much that the quantity required for six gallons of milk in one place is enough for nine gallons in another. The former is the richer milk, and requires much more rennet for the production of a sufficiently firm curd.

Before leaving the dairy, it must be mentioned that to Mr. Fearnall's eldest unmarried daughter is due very much of the credit not only of the uniform excellence of the quality of all the dairy produce, but for the whole superintendence and management of a large household; for many of the men and boys are lodged and boarded in the house, and there is a family of ten, at home, left motherless but a short time ago. There are five children who go daily to school, besides the little ones at home. Two of the brothers help Mr. Fearnall on the farm; and the whole industry and occupation is a most admirable example of united family work. The Judges recommended that the highest mark of approval at the disposal of the Society should be awarded here;* and they highly commended Mr. Fearnall's farm for both its field and dairy management.

* We understand that the Society's Certificate and Silver Medal have been awarded to Miss Fearnall.

The farm is 342 acres, mostly grass, on the level beside the River Dee; some of it is liable to be flooded. The pasture land is 289 acres in all, and there are 55 acres arable—chiefly a light soil—on a higher level, some of it liable to burn. The rent of this farm is 800*l.*; tithes, 57*l.*; poor's rate, 55*l.*; road rate, 21*l.*; in all 933*l.*, or 54*s.* 6*d.* per acre. Much of the grass land has been laid down by the tenant; and the cattle, he tells us, prefer the new to the old grass. The dairy herd is of very admirable quality, containing many first-rate cows, all of them of a Shorthorn character. Some 30 heifer-calves are reared annually, and there are generally a dozen cattle fattened. About 150 fat pigs and porkers are sold annually. Last year's sales included:—20 feeding cattle, 310*l.*; 10 two-year-old heifers, 120*l.*; 14 cows, 186*l.*; 70 calves, 130*l.*; 150 fat pigs and porkers, 416*l.*; and 2 horses, 3 and 4 years old, 90*l.* The cheese, 22½ tons, at 70*s.*, realised 1575*l.*; and the butter, 3010 lbs., at 1*s.*, 150*l.* 10*s.*

No milk is sold. The proceeds of the dairy, including cheese, butter, pigs, and calves, amount to 2271*l.* 10*s.*, or more than 22*l.* per cow; the other sales, draught cows, fed beasts, and horses, amount to 700*l.*

The labour of the farm is done by 3 horses; and there are 3 colts, 2 nags, and a pony besides. No fewer than 6 men and boys are boarded in the house. There are also 2 girls; and the son and daughter who help. The money payment for wages comes to only 163*l.*, but board added would probably amount to 300*l.* in all, the labour of the family not included. This is far lower than on any other farm which we inspected, and of course it is explained largely by the quantity of assistance given by the members of Mr. Fearnall's family; though the proportion of arable land also, it must be remembered, is smaller. The purchases of food during the year included 210*l.* worth of meal, linseed- and cotton-cakes, and 155*l.* in India meal; also the whole of the barley and oats grown upon the land, viz. 350 measures of 70 lbs. each of the former, and 1000 measures of 46 lbs. each of the latter; and there were also 300 measures of beans of 80 lbs., all ground up and used upon the farm, in the shippons, feeding-stalls, calf-boxes, and pigstyes.

Walking over the fields in July, we saw a very fine mixed crop of barley and oats, a good oat crop, very heavy crops of clover and grass, partly won and partly being mown. The turnip field was disappointing—turnips late, resown, owing to the fly. There was also a field of wheat of fair promise. Potatoes are not grown, except for the use of the household. The grass-land was all well grazed, both the night and the day pastures being well watered; and there is an orchard paddock in which breeding

sows were running. In the midst of one of the large level grass-fields a high thorn fence stands, part of which had been removed, this being left for the useful shelter afforded by it to the stock at grass. The premises, arranged as usual round three sides of a square, include a long range with seven separate cross-gangways to every ten cows; and there are other small shippons, other yards and sheds, barn room also, implement shed, and admirable accommodation of all kinds. A 3-horse-power engine is employed to grind and chaff, and pulp if necessary, and thresh. The garden must be mentioned, behind the very complete house, as an example of good management. The farm well deserves the distinction accorded to it both for the character of its dairy produce, the quality of its herd, the labour management and good produce of the land, and for the domestic example to which we have referred.

Mr. Robinson's farm, at Lee Green Hall, Church Minshull, was highly commended. It is 250 acres in extent, sloping from the public road towards the River Weaver, the house and buildings on the farm being on the upper level, and the land lying a compact collection of large fields below it. Most of the permanent grass is on your left, and the arable fields on your right, as you look from the windows of the capital farm-house, which command the whole. A pleasanter home and occupation it is hardly possible to imagine. The buildings are arranged, for the most part, on three sides of a large working square adjoining the house, behind which are the piggeries, not far from the dairy. Of the 250 acres, 176 are pasture; and of the arable there were last year 16 acres in wheat, 22 in oats, 7½ in turnips mostly swedes, 20½ of potatoes, and 37 acres clover and grass in rotation—about half of it two years old. Mr. Robinson is perfect master of his land; he can plough up what he pleases; and there are no restrictions on his cultivation. That he can lay down as well as break up, we had ample proof. A large field of grass-land, which he had lately laid down, carried more than a cow per acre all through last summer, and was extraordinarily full of clover, and other keep, when we walked over it in July. It had been laid down with 12 lbs. of red clover, 3 lbs. of alsike, 4 lbs. of trefoil, and 1 bushel of Italian rye-grass, per acre—sown with an oat-crop, and grazed with store-cattle till the following April. It received 10 cwt. of boiled bones per acre in March, was once mown for hay that year, and subsequently grazed, receiving a half-dressing of manure in the second winter, and the cattle pastured on it received 3 lbs. of cotton-cake daily, equal to at least 5 cwt. per acre during the summer months. The pastures generally are well grazed. A

few ewes are annually purchased for winter grazing—half-bred Cluns—they are lambed in the following spring, and sold as soon as saleable thereafter. Thirty ewes and 45 lambs had thus been kept during the previous winter. The lambs had been sold at 37*s.* each, the wool at 10*d.* per lb.; and the ewes kept on sheltered low-lying pasture get fat without artificial aid. Eighty cows are kept on the farm, 78 had been milked during the previous season, of which 21 were three-year-old heifers, and 15 two-year-olds. We saw also 19 yearling heifers, which had already (July) received the bull. The bull-calves are generally kept and fed till worth 45*s.* a-piece; and some 20 heifer-calves are brought up annually. The pig-stock includes 9 or 10 sows, and 50 or 60 pigs are sold every year.

Lee Green Farm is worked by 5 horses, 2 of them being breeding mares. The hand-labour of the farm is done by one cowman, two carters, and two labourers; and of these—two men, besides two dairy-women, and one girl and a boy, are boarded in the house. The money-wages include 15*l.* extra payment during hay-harvest, 18*l.* during potato-harvest, and 19*l.* during corn-harvest, and amount in all to 200*l.*; and if the cost of boarding servants in the house be added, it is probable that the whole expenditure on labour is 300*l.* a year, or 24*s.* an acre. The other outgoings include purchases of food and manure—3 tons of linseed-cake, 8 tons of cotton-cake, 200 sacks of bran, 100 quarters of India corn and meal, and 85 cwt. of rice-meal. It should be mentioned also that all the oats grown, some 20 acres, are consumed upon the farm; and that 12 quarters out of the 64 of wheat produced on 16 acres of land, are also consumed. The manures purchased cost about 210*l.* a year, viz. 180*l.* in bones, 30 cwt. of guano, and 2 tons of superphosphate. Mr. Robinson has also done a great deal during his tenancy for the permanent improvement of his farm. He has built a feeding-house for pigs. Three cisterns to receive the whey from the dairy are provided with a chain-pump. He has enlarged the milk-house, made a shippon for 6 cows, carted all the material for his new house, and for a block of buildings, 40 yards long by 8 yards wide; he has paved 2000 square yards at 6*d.* per yard; made a watering-place, carted 200 tons of ashes 5 miles for the farmyard and gateways; eradicated 8000 yards of old hedges, and planted 3100 yards of new ones, quicks being found by the landlord. He has marled several fields, and drained 40 acres, and filled up a number of old pits, and carted on hundreds of loads of earth and soil to make the same into land. He has erected 200 yards of iron fencing, and has spent large sums in bone-manure, and other bone-fertilisers; spending, indeed, upwards of 1000*l.* for manures during the

past five years. The farm has been in his own hands for twenty-seven years, and had been in his father's before him for thirty-five years. The rental is 500*l.* a year, and this, with the tithe, 27*l.* 10*s.*, land-tax, 1*l.* 1*s.* 8*d.*, poor's rate, 45*l.*, and other rates, 6*l.* 10*s.*, amounts in all to 580*l.* 1*s.* 8*d.*, or 2*l.* 8*s.* an acre. So good a rent, and so well managed and cultivated a farm on so big a scale, is a capital testimony to the good working of the system of landlord and tenant. Nor has the former neglected his duty, for since a former visit, eight years ago, to this farm at the last Liverpool competition, we find an important addition to the farm-house, which is now a very charming home; large additions also to the buildings, and a new range, including stabling, waggon-house, with granary over, with loose boxes added.

The receipts from the farm last year included 320 cwt. of cheese, 68*s.* the cwt., 1088*l.*; 1750 lbs. of butter at 1*s.* 3*d.*, 109*l.* 7*s.* 6*d.*: a small quantity of milk, 15*l.*; forty fat pigs, 200*l.*; in all 1412*l.* 7*s.* 6*d.*; or about 17*l.* 13*s.* a cow—a smaller receipt than others we have quoted, probably owing to the smaller quantity of milk which is sold. The quantity of cheese, which has averaged 4 cwt. per cow, is a very fair yield. In the earlier months of the cheese season an unusual method of making is followed. The evening's milk, which has been lying in the tub is partly skimmed, and the morning's milk is added as it comes in, at a temperature not higher than 80°—obtained by the use of cold water below the false bottom of the tub, if necessary, during the summer months. Essence of rennet is added, ½ a pint to 180 gallons, from which 3 cheeses are made. The curd is set in about three-quarters of an hour. It is cut in the usual way, and 6 gallons of yesterday's whey is added, and the whole mixed up, remaining for an hour. Then it is turned over and lifted by bowl, whey and all, upon a cloth over a tub, and on this it lies for three hours, until the whey has dribbled from it, the skimmer being used occasionally among it to turn it over and mix it up. The curd being then no longer obviously wet, but still holding a good deal of whey amongst it, is put layer after layer, alternately with salt, in a pan, three pans to a cheese, a quart of salt being thus used to every pan. A great deal of whey has still to come from it, and therefore much of this salt ultimately escapes. In this state, unground, it is pressed carefully into the cheese-vat, left there in the cold cheese-tub till next day, not put under pressure till the second day; turned out into clean cloths every day: put under half-pressure the second day; kept under comparatively low pressure till the fourth day, and thereafter under full pressure for several days, being always daily turned and clothed. No colouring is used. There is a

demand for this class of cheese, which rather affects the Stilton type; and at three to four weeks old, lying that time and turned daily on straw on the cheese-floor, it is ready for sale; and 66*s.* to 67*s.* was made per cwt. last spring.

The other receipts include a certain number of old cows fatted off; 15 were sold the previous year, at 15*l.*; 40 bull-calves at 45*s.*, 90*l.*; 30 sheep at 53*s.*, 79*l.* 10*s.*; 45 lambs at 36*s.*, 81*l.*; 1 horse at 35*l.*: and besides this, 52 quarters of wheat were sold at 42*s.*, 109*l.* 4*s.*; 80 tons of potatoes at 4*l.* 10*s.*, 360*l.*; 15 tons of hay at 5*l.*, 75*l.*; 8 tons of straw at 24*l.* Rents and labour and food and manure, on the other hand, cost 1471*l.* in all. The promise of the crops, as we saw them in July, was as fine as of any that we saw anywhere. There never was a better show of swedish turnips at the time of the year,—the ground being already covered with a healthy growth of evenly singled plants. The potatoes were most promising, the clover-land was admirable, the oats and wheat were both even, upstanding crops; and the lately laid down grass-land was extremely good. The whole farm was under admirable management; and nothing could be better, more full of life and energy—master, mistress, family, and household, all praiseworthy. So much praise, it may be thought, is hardly consistent with the humble place given to this farm in the final award. The Judges were specially instructed to take the quality of the stock into their consideration, and although the yield of cheese per cow is a fair testimony to the character of the dairy-stock, yet the general character of the herd was certainly not equal to that of the other farms inspected. One noticed, too, several cows that had lost one of their quarters, and several others with their hips knocked off: and their general management lacked somewhat of the quiet kindliness characteristic of good herdsmen.

Mr. Cyrus Lea, of Duddon Hall, in the parish of Tarvin, has earned a high commendation for the management of his farm of 152 acres, of which 50 acres are permanent pasture, 44 grass and clover, laid down by the tenant, which he has the power, if he pleases, to plough; and 55 acres are in crops. This last-named area was last year cropped as follows: 12½ acres of wheat, 25 acres of oats, 5 acres of swedes, and 12 acres in potatoes. The rotation adopted is—1st, oats; 2nd, green crop, including potatoes and swedes; 3rd, wheat; 4th, oats sown down with clover; and thereafter clover mown, and clover pastured as long as may be desired. If we may refer to this farm in the order in which the impression which has been made upon us by its several features remains, the magnificent crop of oats through which we waded last July stands first upon the list—certainly the finest

thing of the kind anywhere to be seen. The premises, which have been lately refitted and somewhat extended, now leave nothing to be desired—shippons, pigstyes, barns, and renovated farm-house, are all now satisfactory. The water supply has been Mr. Lea's own arrangement. It is delivered from a considerable spring on a lower level by a hydraulic ram, to which, by skilful management, fall enough was obtained for the purpose required. The spring is 170 yards from the premises; the ram is fed by a 2-inch pipe with a 5-foot fall, and delivers through a $\frac{3}{4}$-inch pipe to buildings 15 feet to 20 feet above its level; the whole costing 83*l.* The cow-stock here were a remarkably fine herd of 50 in milk, and the young stock promise to keep up its quality. We nowhere saw calves or yearlings doing better. The rent of the farm is 300*l.*; tithes, 26*l.* 17*s.* 10*d.*; poor's-rate, 23*l.* 17*s.* 10*d.*; school-rate, 16*s.*; in all 351*l.* 11*s.*, or more than 2*l.* 2*s.* an acre. The labour is done by three men, whose wages average 40*l.* a year, and one dairy-woman at 16*l.*, and two boys at 12*l.* and 8*l.*, who live and are boarded in the house. The extra labour includes 30*l.* at the corn and potato-harvest. Taking the cost of board into consideration, the labour account altogether probably amounts to 220*l.*, or nearly 30*s.* per acre. The consumption of bought food during the year amounts to $2\frac{1}{2}$ tons of linseed-cake, $5\frac{1}{2}$ tons of cotton-cake, 36 quarters of India meal, 3000 bushels of brewers' grains, in all 193*l.*; 9 quarters of wheat also, and 53 quarters of oats of home growth, have been consumed. The manure bill includes 3 tons of bone-superphosphate, at 10*l.* 10*s.*, and 9 tons 1 cwt. of bones, altogether 68*l.* a year. The sales include 320 cheeses weighing 8 tons 14 cwt., at 68*s.* to 70*s.*, 602*l.* 4*s.* 4*d.*; 630 lbs. of butter, at 1*s.* 4*d.*, equal to about $\frac{1}{2}$ lb. per cow per week, 42*l.*; 3283 gallons of milk, at 11*d.* to 1*s.*,—151*l.* 16*s.*; 29 fat pigs, 163*l.* 6*s.* 9*d.*; 10 fat cattle had been sold for 181*l.* 15*s.*; and 32 calves for 32*l.*; and the sales of wheat, potatoes, oats, and straw amounted to 439*l.* 5*s.* 9*d.* The sales of butter, milk, cheese, pigs, and calves, come to 991*l.* 7*s.* 9*d.*, or 19*l.* 16*s.* per cow. The receipts for milk, as will be seen, very materially added to the returns.

Mr. Cyrus Lea has done a good deal to the improvement of his farm during the 15 years of his occupation. He has eradicated $4\frac{1}{4}$ miles of old fences, and has prepared for and planted $2\frac{1}{2}$ miles of new quick fences, draining and filling 15 useless marl-pits, and reclaiming 3 acres of waste; he has also drained 21 acres, the landlord finding tiles; and he has provided, as we have said, a hydraulic ram for water supply, and erected at his own expense a hay barn, also iron fencing, pavement for yard, &c.—at a total cost exceeding 700*l.*

On walking round the farm, among the noteworthy points were the excellence of the fences, the well-grazed character of the pastures, the admirable herd of cows, the heavy swath then being cut in the meadow at the lower part of the farm, the very promising lot of young heifers in the farther grass-field, the wonderful crop of oats, and the fair and even but not heavy crop of wheat; the even plant and general merit of the potato-field; the swede-field, somewhat late and patchy—owing to an unsuccessful fight with the fly, at one end of it. The Dutch barn, to which reference has been made—30 yards long by 7 wide and 18 feet high up to the eaves, with corrugated iron roofing, pitch-pine uprights, and spouting, with down-spouts—cost 83*l.* 15*s.*

There are two other farms in this class which deserve mention for energetic and successful management. Mr. John Mackareth occupies 179 acres, of which 80 are arable at Cockerhouse, in the parishes of Cockerham and Garstang, the property of Major C. H. Bird, of Garstang, at a rent of 360*l.* Tithe, land-tax, poor's rate, &c., amount to 50*l.* more. In addition to the consumption of much of the grain produce of the farm, he purchases $1\frac{1}{2}$ tons of cake annually besides some 14 quarters of wheat, 12 of barley, 50 of oats, and 23 of beans grown upon the land. He grew last year $16\frac{1}{2}$ acres of oats, $5\frac{1}{2}$ of beans, 11 of wheat, 8 of barley; the rotation being oats or beans, green-crop, barley, and clover one or two years in succession. The green crop includes 6 acres of potatoes. He milks 28 to 30 cows; and sold 4 tons 18 cwt. of cheese and 1600 lbs. of butter in 1884; and he feeds 8 to 10 cattle annually. Five were sold at 12*l.*, and five at 23*l.* each last year. His farm is well equipped with home buildings, and has in addition a small homestead at a distance. The cow-stock are very good. The landlord has applied 300*l.*'s worth of bones—40 tons over 48 acres—charging 5 per cent.: the tenant's purchase of manures in addition to this includes 50 tons of corporation manure, delivered by canal upon the farm at 4*s.* 4*d.* a ton. The substantial stone-built home buildings near the farm-house at the upper end of the farm, include a capital shippon for 20 cows, stable for six horses, hay-barn, stalls for fatting beasts, and piggeries. In the outlying homestead there is a shippon for 20 cows, loose boxes for calves, granary, &c. The young wheat here was so eaten down with hares in the spring that we could hardly see what it was. It was impossible for it to be a paying crop under such treatment.

Mr. William Bradley, Arnott Farm, Little Marton, near

Blackpool, occupies 175 acres on the Clifton Estate, at a rent of 309*l.* 15*s.*, with tithes and rates amounting to 47*l.* additionally. It is partly black soil which has been dug for peat during the tenant's remembrance. Mr. Bradley himself has been the tenant during two leases of 14 and 21 years respectively, four years of the last lease being still to run. During this period he has spent a great deal in both the permanent and annual improvement of the farm. The sum of 260*l.* was spent on buildings in 1859 and 1870; more than a mile of new fences has been planted during the tenancy. He has drained, three feet deep, 13 acres of clay-land; made roads half a mile in length; removed 4266 yards of old fences; and added nearly three acres of land by filling up marl-pits and ditches; and he has purchased and applied 77 tons of bones and 290 tons of guano during his tenancy. He milks upwards of 40 cows. His make of cheese in 1884 was 6 tons 10 cwt. from 37 cows, 11 of them heifers. There is a flock of 30 to 40 lambing ewes. His purchases of food include 2½ tons of linseed-cake and 130 packs (240 lbs. each) of India meal, costing altogether about 110*l.* a year. He consumed also, in 1884, 500 bushels of oats, 20 quarters of beans, and 7 quarters of wheat. His arable land was not so well done as his pasture. Nothing could be better than the latter; much of it laid down by himself; full of clover and good food.

CLASS IV.—In the 4th Class of Farms in the Preston competition—Dairy Farms under 100 acres in extent—there were 8 entries, 5 in Cheshire and 3 in Lancashire. The first prize has been awarded to Mr. Edward G. Hothersall, of Lightfoot House, Broughton, Preston, who here occupies 97 acres, 80 of which are the property of T. K. Knowles, Esq., of Fishwick Hall, Preston. The whole of the land is permanent pasture—80½ acres being divided, 2 fields from 8, by the high road to Preston, and bounded on one side by another highway, called Walker's Lane—and 18 acres, an outlying piece at no great distance. It is wholly permanent grass-land, of which 39 acres are mown each year. The land lies in 11 fields, the result, to a great extent, of Mr. Hothersall's rearrangement of fences. The fields have all good drinking places; and this also is to his credit. The fences are in capital order, to some extent new; quicks planted two years ago have already an extraordinary growth—due to careful planting, and subsequently sousing with liquid manure twice in the year. The new fence is protected by wooden paling far enough from the quicks to allow a swathe of grass to be cut, which is carried to the stalls. The public roads furnish access

to most of the fields; but there is also a private farm road to the farther grass fields. They lie generally 2 fields deep one way, and 4 fields deep another. The homestead is a remarkable example of good arrangement—compact and well connected throughout; and there is another outlying homestead, including barn (part of which is allotted as shippons) with open yard, at the farther end of the farm abutting on Walker's Lane. And to this all purchased cattle are first taken as to quarantine; for here is a farm where the whole stock is maintained by continual purchases, and weeded by continual sales. Mr Hothersall does not buy in open markets, and has by his careful management in this respect never had foot-and-mouth disease upon the farm. He is well known by many farmers in Lancashire and Westmoreland as the buyer of good stock, both cattle and horses; the former solely for his own dairy, for which, as we have said, he thus always buys on one or other of the many farms where he is known in the two counties. The whole of the stock upon the farm, whether horses or cattle, bears admirable testimony to his good judgment and market skill. Lightfoot Farm is, in fact, an example of success, especially deserving of its place on the present list for the illustration which it gives of skill and good management in marketing at both ends of the business. Mr. Hothersall is both a good buyer and a good seller: and being also a good farmer of both land and stock, he derives a large revenue from his comparatively small occupation. It will be no offence to himself, if we quote his own words with reference to his career: "I lost my father early," he says, "but I had a good mother. We had a small farm, and I helped in the shippons from early boyhood—going to school every morning and coming back to help milk in the evening. The work for me, as boy, was stripping after the milkers." With such good schooling as enables him to keep very detailed accounts, with a natural aptitude and taste for farm work, and a knowledge of stock from the very beginning, and with industry and thrift implanted in him from the first, he at length swarmed off from home with such means as he possessed. Known as a desirable tenant, this farm was offered to him nine years ago by the agent; and he took it, knowing that he was not ousting his predecessor. He began with only 20 cows upon the farm, for which indeed he had to buy hay during his first winter. He now milks 48 to 52 regularly, keeping them or selling them as it seems to his interest to do. As many as 20 were bought last year; and the stock is replenished by well-selected purchases according to the demand for milk. They are a remarkably fine herd; we saw nothing finer in the course of our inspection. Mr. Hothersall has since taken Lord Vernon's

prize for the best herd of dairy cattle. Messrs. E. C. Tisdall, Williams, Bell, and Algernon Fawkes, with whom the decision rested, reported that in respect of (1) selection of cows, (2) average yield of milk, (3) greatest yield of milk on the day of examination, (4) least number of acres per cow, and (5) greatest percentages of fat and of total solids in the mixed milk of the herd, Mr. Hothersall's herd was far superior to all its rivals in the competition. Our own notes of it, as lot after lot were inspected, whether in shippon or in field, are sprinkled over with such words as "beauties," "splendid cattle," "extraordinarily fine."

The receipts from the farm are mainly for milk sold morning and evening in Preston, taken there either by one of the farm lads, or by the eldest son of the tenant, now 10 or 11 years old. It is supplied generally to private customers, only to a little extent to one dealer. The boy receives the value of his first day's sale of milk to any new customer, whatever the amount of it may be, this being his fee for an extension of the business, so that he is always on the look out. The milk costs 3*d.* a quart delivered at the door, or 4*d.* for the strippings. The amount sold varies from 100 to 120 gallons a day, from 46 to 52 cows; 48½ gallons was the daily sale in July last at 3*d.* a quart, and 9 gallons at 4*d.*; 5 gallons were retained. Most of the evening's milk is retained and skimmed for butter, 36 gallons of skim-milk being sold at 2*d.* a quart. About 120 lbs. of butter a week are thus made, and sold at 1*s.* 2*d.* to 1*s.* 10*d.* per lb. according to the season. The sales for milk and butter during the previous year amounted to 1808*l.* 6*s.*, equal to 36*l.* 18*s.* 1*d.* per cow, over 49. The other sales of the year included 17 cows, 7 fat cattle, and 44 calves, realising 661*l.* 10*s.* Nineteen cows and heifers had been bought for 495*l.* 9*s.*, and 7 bullocks for 53*l.* 4*s.* Thirteen horses had been sold for 818*l.* 15*s.*, 12 having been bought for 529*l.* 10*s.* Sheep and lambs had been sold for 161*l.* 8*s.*—73 sheep having been bought for 83*l.* 7*s.* A few pigs are also kept, and a sufficient quantity of poultry, but neither of these is an important item. Such a large stock is of course maintained only by large purchases of food: no less than 645*l.* was spent last year, or 6*l.* 13*s.* per acre. It included the following items: linseed-cake, 3 tons 12 cwt., 32*l.* 4*s.* 6*d.*; cotton-cake, 6 tons 2 cwt., 48*l.* 17*s.* 4*d.*; "sharps," 37 packs (240 lbs.), 27*l.* 15*s.*; wheat, 10 packs, 8*l.* 5*s.*; bran, 19 packs, 10*l.* 9*s.*; oats and barley, 79 bushels, 13*l.* 16*s.* 6*d.*; beans, 28 packs, 24*l.* 10*s.*; Indian corn, 230 packs, 157*l.* 17*s.* 8*d.*; oatmeal, 76 packs, 100*l.* 19*s.*; rice meal, 153 packs, 74*l.* 2*s.*; brewers' grains, 3515 bushels, 117*l.* 8*s.*; hay and straw, 6 tons, 14*l.*; swedes and mangolds, 6½ tons,

4*l.* 16*s.*; potatoes, 110 packs, 16*l.* 10*s.*; total, 651*l.* 10*s.* 1*d.* = 6*l.* 14*s.* 3*d.* per acre.

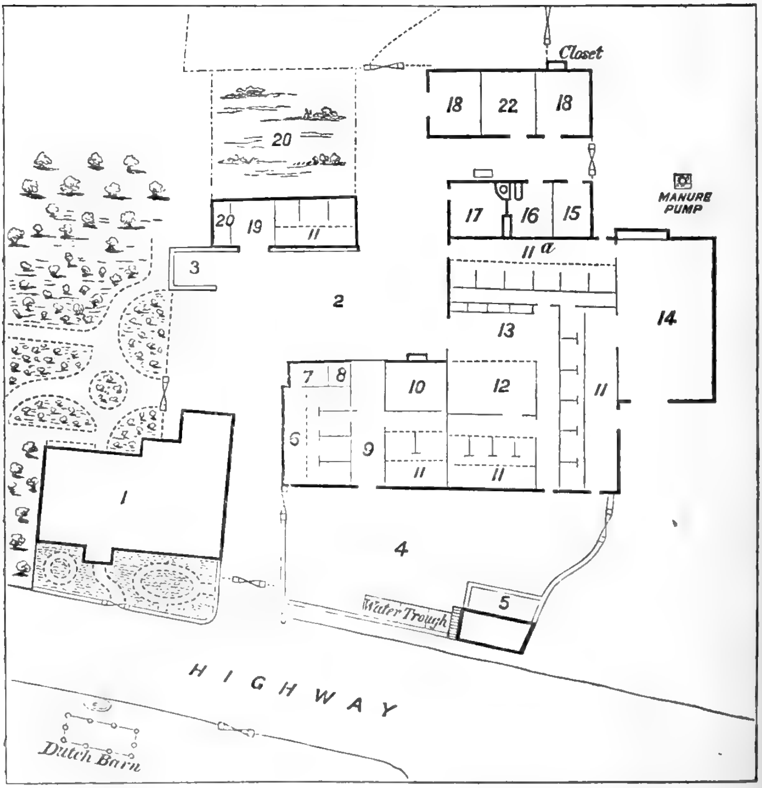
The natural produce of the land is maintained at its utmost by good farming. In 1884, in addition to the large quantity of home-made manure from the enormous consumption of food —carefully collected both in tank and under cover—102 tons of farmyard-manure and 52 tons of town manure, and 4 tons of bones and 12 tons of shoddy manure had been purchased at a cost of 60*l.* 18*s.* 9*d.* Large quantities of sawdust also are purchased for use as litter.

The labour of the farm is done by 2 men, at 24*l.* and 20*l.* apiece, with board; one man at 7*s.* a week and board; 2 boys, 16*l.* with board; and 2 girls, 14*l.*, and 15*l.* respectively with board; with also about 40*l.* of extra labour, whether at hay time or during winter in draining, fencing, &c. In all, the money payment for labour is 147*l.*; but the board, which is very liberal, four meals a day, with meat at least at one of them, adds of course materially, probably to the amount of at least 80*l.* a year. The day begins at 4·30, milking is finished by 6, and the milk delivered at Preston between 7 and 8, four miles off.

The rent paid for 80 acres, on which 20 cows were all that could be kept during the first year, is 252*l.* 12*s.* In addition to this, the outlying 18 acres commands a rent of 50*l.* The rates in addition, of all kinds, come to 35*l.* a year, and the total rent for 98 acres is 338*l.* 8*s.* 6½*d.* Lightfoot Farm, however, is not merely a farm, it is a manufactory—it is a milk and butter factory—a place also where a small but good business in horse-dealing is carried on. The Manager is thoroughly capable on all sides of his work. He knows how to manage land and stock, and how to buy and sell. He employs his own good judgment and a large capital for the extent he occupies, and labour to the extent probably of 2*l.* an acre, without counting his own most efficient assistance. He does his buying and selling safely, wisely, skilfully, and he reaps a profit notwithstanding his enormous rent. Does anybody say that this is rather a commercial than an agricultural concern—that this was not the business contemplated in the offer of the prize which has been awarded to it? We say that it is not only a remarkable example of good farm management, but a praiseworthy instance of a kind which deserves especial recognition now. The commercial side of farming is one of the most important of the conditions on which agricultural success depends. And Mr. Hothersall's position is due not only to field and live-stock management, but to his careful personal attention to both buying and selling, on both of which the success of farm management very largely depends. The farm

has been to an extraordinary extent equipped by the tenant himself. The modest and comfortable farmhouse, and a certain extent of shippon, stabling, barn room, were originally provided. The barn and shippon at the farther end also is the landlord's property, but of the quantity of building represented in the adjoining plan, it is surprising to find how much has been erected by the tenant. In taking out and rearranging fencing, in new roads and gateways, in providing watering-places in the

Fig. 2.—*Plan of the Lightfoot Farm Homestead, in the occupation of Mr. E. G. Hothersall.*



1. House and garden.
2. Farm-yard.
3. Coals, &c.
4. Stock-yard.
5. Piggeries, store-room for sawdust over.
6. Stable.
7. Harness-room.
8. Tool-house.
9. Cart-shed.
10. Bull-house.
11. Shippons for 42 cows.

11*a*. Cake-store and chopping-room over.
12. Hay-barn.
13. Steaming-house.
14. Covered manure-shed.
15. Stable.
16. Engine and grinding-house.
17. Churning and wash-house.
18. Loose-boxes.
19. Coach-house.
20. Poultry house and yard.
22. Shippon for 5 cows.

fields, in new hay barn capable of holding 580 yards of hay, shippons for 25 cows, 3 horse-boxes, additions to the house, Dutch barn for hay in the adjoining field, painting all woodwork three times, &c., the whole expenditure by the tenant has been 838*l.* 10*s.* 3*d.*, and by the landlord 234*l.*, during his seven years' occupancy. The tenant had to spend also 100*l.* in hay during the first year of his nine years' lease, of which two are still to run. The cow stock, all obtained by purchase—generally bought in-calf, and got the cheaper for taking that risk at home—have averaged 24*l.* apiece; and they are kept two or three years, being calved on the premises, or sold earlier, as the tenant chooses, the calves going generally for 50*s.* to 3*l.* apiece. If there be any risk of milk-fever, the cow is drenched with linseed-oil two or three times before calving; and if she falls after calving, a pint of whiskey with a quart of drench, containing a quarter of a pound of Epsom salts and six pounds of treacle, is given; and mustard embrocation or plaster is applied over the loins, and she is well wrapped up.

Mr. Hothersall showed us the books which he kept. A daily journal; a cash book; a provender book; a stock book, with particulars of purchases and sales; a milk notebook; a horse notebook, with particulars of purchases and sales; and a general outlay book. It is not necessary to transfer any of their particulars here; the general totals have been already given. The purchase and sale of horses—farm horses generally—has almost always been profitable. There are one or two examples in the year of loss to be recorded, but generally Mr. Hothersall's good judgment has been justified by a profit, sometimes very large indeed. And we saw on his premises during all our visits generally three or four very valuable horses, either preparing by food and exercise for re-sale, or doing their share of work meanwhile on the farm.

Going round the buildings, of which the plan (Fig. 2) accompanies this Report, we find them very compactly connected, shippons numbering 11 and 11*a* being arranged around the central barn; and in direct connection with No. 14, a covered yard with concrete floor, and with a liquid-manure tank. Everything was seen in the most perfect order during all our visits. The tool-house, also the harness-room, are surprisingly well equipped. The farther shippons, No. 22 and No. 11, had been erected by the tenant—wooden sides on brick footings, with felt roof. A 4-horse-power upright engine by Barford and Perkins, costing 95*l.*, has been also erected by the tenant. It grinds, and cuts chaff, and pumps water, and provides steam for the steaming-boxes. The cows were receiving on our Midsummer visit 7 lbs. daily of meal in half a bushel of mash, which

included oil-cake, chopped potatoes, and grains, besides mixed oat- rice- and India-meals. A certain amount of straw litter and sawdust also is used in the shippons; and the whole of the manure is mixed with purchased stuff—shoddy, slaughter-house waste, mill sweepings, and Corporation manure—upon the concrete floor of the covered pit, to which reference has been made. There it ferments, and is mixed and carried out in the late autumn months to the grass-lands, whether pasture or meadow, in succession; and nowhere is manure more carefully or evenly spread than in this district. Being very short, it can be done literally with special attention to every square foot of surface. This farm and its general management are well worthy of inspection, as it teaches many valuable lessons. Amongst others we may mention how necessary it is that everything should be put away in its proper place, in order that it may be found at once when wanted. Also here you will find exemplified the good old maxim, that "a stitch in time saves nine." The whole farm is an example of good management in dairy, homestead, market-place, and field alike—an illustration of the fact that success depends very largely on good marketing, both at the beginning and the end of the process.

The second prize in this Class is awarded to Mr. Jonathan Fowler, of Free-Bull Farm, Ashton-on-Ribble, within 3 miles of Preston, who there holds 65 acres of permanent grass-land, the property of W. Birley, Esq., of Ashton-on-Ribble, paying for it no less a rent than 250*l.* a year, which, with rates and tithes equal to 19*l.* a year, amounts altogether to 269*l.* 1*s.* 10*d.*, or 4*l.* 3*s.* per acre. It is useful pasture land, some of it very good indeed. We saw a very heavy crop of grass in course of hay-making in one large field, and a large stock of remarkably fine cattle in another large field, on our Midsummer visit. This is another case of a herd kept up by constant purchase for milking purposes. Thirty-five cows are in milk, and no fewer than 24 cows were bought last year, costing 541*l.* 10*s.*, or 22*l.* 11*s.* 3*d.* apiece. The sales from the herd during the same period included 22 sold fat, at an average price of 26*l.* 6*s.* 6*d.* each, realising 579*l.* 0*s.* 6*d.* There were also 18 calves sold at an average price of 1*l.* 16*s.*, and 7 fat calves for 3*l.* 12*s.* 5*d.* apiece. Many of the cattle, it will be seen, were bought as in-calvers. Sixty sheep were bought for 98*l.*, and sold for 125*l.* 9*s.* 3*d.*; 11 pigs were bought for 24*l.* 11*s.*, and sold for 64*l.* 5*s.* Two horses are worked on the farm, one of them available for the milk-cart. The sale of milk was 5475 gallons of skim-milk, at 8*d.*; 2190 gallons of strippings, at 1*s.* 4*d.*; 8395 gallons whole-milk, at 1*s.*, sold to private customers, and

2190 gallons sold to dealers at 9*d.* a gallon. The milk sales thus realised 830*l.* 7*s.* 6*d.*, and with pigs and calves the sum reached amounts to 36*l.* 2*s.* apiece over the 35 cows. Mr. Jonathan Fowler's stock are liberally treated. The purchase of food comes to nearly 560*l.* a year, including 11 tons of linseed-cake, 99*l.* 16*s.*; cotton-cake, 8*l.* 3*s.* 9*d.*; barley and beans, 7*l.* 18*s.* 6*d.*; Indian corn, 7*l.* 15*s.* 6*d.*; India meal, 333*l.* 2*s.* 2*d.*; desiccated brewer's grains, 86*l.*; straw, 13*l.* 2*s.* 7*d.* The cattle and pigs are all housed in very comfortable buildings, arranged, as usual, on three sides of a square. The farmhouse looks like a villa residence; but the family living in it are plain, hard-working people. The milk is carried directly to the houses of many private customers. This is done by one of the daughters, who keeps the accounts and collects the payments weekly. A large quantity of butter—100 lbs. a week at the time of our Midsummer visit—is made: the average of the year being 90 lbs. a week. If to the 12,775 gallons of whole-milk which are sold, there be added the quantity of milk which is required to yield 4680 lbs. of butter—probably something like 13,000 gallons—it will be seen that the quantity of milk yielded by the 35 cows is close upon 26,000 gallons, or rather more than 730 gallons per cow; and this is not at all a considerable thing, considering how rapidly the cows are changed in the course of the year, 22 having been sold and 24 bought in 1884: and that they are well done is plain from the enormous quantities of food annually bought for them. In fact the yield is not 730 gallons per cow, but 730 gallons per stall—a very different thing, for the stalls are being constantly changed, and kept always occupied by cows during their productive period.

The land also is well done, the grass being dressed and boned alternately—some 12*l.* to 14*l.* worth of artificial manure being bought annually, and use being made of the liquid-manure tank. The farm manure is well cared for, as, derived from the consumption of so much purchased food, it deserves to be. A well-enclosed central stance for it is roofed in, and to some extent also walled in, with sheets of corrugated iron. The corn bought comes to 10*l.* a week, and putting cows and pigs and other stock together, and reckoning the whole as equal to 40 full-grown cattle, this is equal to 5*s.* per week of bought food per head, equal to the purchase, in fact, of 10 lbs. of meal or cake per head daily. The whole farm and the business on it is plainly all well in hand—managed by a very capable tenant and his family. It may be mentioned also that a garden yields 12*l.* worth of rhubarb annually, besides garden stuff for house use. It is a highly rented farm in capital condition. The landlord has provided good buildings and an unusually good house.

Fences, gates, stiles, fields, ponds, are all in good order—fences, where needing mending, are mended, quicks having been planted and properly protected ; and the cattle are first-rate.

Mr. Thomas Lowe, of Higher Hall, within a mile of Malpas, is highly commended for the very nice little farm of 87 acres—of which 39 are arable—which he holds, lying on a slope facing the south-west, with the public road running through the lower part of it, and the excellent house and premises on the upper level. Everything about the place is substantial and good, especially the very good house and well-arranged homestead. The rent is 220*l.*, or, with rates, land-tax, and tithes, 254*l.* 8*s.* 11*d.* per annum. The place is full of stock. There is a herd of remarkably good Shorthorn dairy cows, some of them as good as any that we saw. The land is well done, the grass-land full of keep, and the arable crops very satisfactory. Oats on our last visit promised a remarkably fine crop; the clover was first-rate; the small area of mangold-wurzel forward ; potatoes good ; swedes late, having been resown, but at length promising a plant. The rotation followed is (1) oats; (2) green cropping, viz. potatoes, mangold-wurzel, and swedes; (3) oats, followed by one, or two, or three years' clover. Last year the cropping was: oats, 10½ acres ; clover, 24 ; mangold-wurzel, 1 ; swedes, 3¾ ; potatoes, for home use, 1 rood. In addition to the mown clover, a certain quantity of the meadow land is also mown for hay. All the swedes and mangolds grown, and all the oats—in fact, the whole produce of the land, both arable and pasture—are consumed, and about 120*l.* is spent on cake and India meal. The stock include 3 horses and a nag, 38 cows, 5 heifers calving at three years old, 42 pigs, besides calves. Everything is fattened off; 36 fat calves fetched 112*l.* 7*s.* 6*d.* ; other fat cattle, 100*l.* 2*s.* 6*d.*; 31 fat pigs fetched 143*l.* 5*s.* last year, besides 4 fat hogs of 11 score each killed for use in the house ; and 161½ cwt. of cheese were sold at about 70*s.* per cwt. realising 571*l.* 19*s.* 2*d.* There were also 800 lbs. of butter sold in the year—about 20 lbs. a cow: no milk-butter is made: this represents only the skimmings of the whey. Five cows were purchased last year and 5 were sold, and the herd is thus to some extent kept up by purchase; but it is essentially a stock farm, and the quantity of stock per acre is as great, considering the smaller portion of artificial food that is purchased, as on any of the farms inspected. This is probably owing to the large proportion which is arable. Certainly 3 acres of clover, green crop, and oats, respectively, yielding such crops as we saw, are capable of maintaining a larger quantity of stock than 3 acres of grass-land, good as that here is. About 16*l.* worth

of bone-dust and superphosphate are bought for the turnip crop every year. Food and manure together come to about 140*l.* a year, or 32*s.* an acre, nothing like the amount reported of other farms; but here, as has been said, the whole produce of the land is consumed at home, both green and grain crop; and in this respect it is unique among the farms we visited, no potatoes even being sold.

The dairy management is not particularly noteworthy, excepting that no cream whatever is taken from the milk, though the price reported to us for the cheese was not higher than on most of the other farms. The floors of cheese which we had the opportunity of inspecting were not quite equal to those which we had seen elsewhere; Mr. Lowe, however, certainly deserves the high commendation which he received. The labour of the land is done by one cowman and one carter, receiving 20*l.* and 18*l.* respectively, and board; one dairy woman, who is also housekeeper, and two girls, receiving 30*l.*, 16*l.*, and 10*l.* respectively, and board; and there is about 5*l.* worth of extra labour at hay and corn harvest. The whole amounts thus probably to 180*l.* a year; this large expenditure is, however, to some extent owing to the housekeeper's wages, 30*l.* a year, being included. Mention should be made of the garden; the house and garden and general surroundings are really those of a country gentleman.

There are many other farms of the same class which deserve notice if we had space at our disposal; shorter references to these, however, must suffice.

Mr. Samuel Walley, of Rowley Farm, Elkinton, Tarporley, occupies 67 acres, rather high-lying and also outlying, for it is 9 miles from a market town. He has been tenant for eighteen years, during nine of which he had managed it for his mother. He was born on the place, which was held by his father and grandfather before him. Of his 67 acres, 12 are in grain and green crop, including 9 acres of oats, 1 of wheat, 1½ of swedes, 1½ of mangolds, 2 of potatoes; and there are 15 acres of clover and 36 acres of permanent grass. All except two fields had been laid down by the tenant, and he could plough up any of them, being only restricted to 18 acres of ploughed land in the year. He milks 20 to 22 cows, and keeps a flock of 40 or 50 sheep, buying in either ewes and selling them with their lambs or shearlings, and keeping them through the winter and spring. His sales last year included 18 calves, 40*l.* 1*s.* 6*d.*, and one cow, 13*l.* Several of his cows were that year with their first calves, and only 65½ cwt. of cheese accordingly was made, which realised 70*s.* a cwt., or 234*l.* The sales of pigs (both fat and stores,

amounted to 114*l.* 3*s.* 9*d.*; of butter 663 lbs. were sold at 1*s.* 3*d.* = 41*l.* 8*s.* 9*d.*; and 179 loads of potatoes at 4*s.* 6*d.* The labour of the farm required three men, two at 10*l.* and 26*l.* respectively, with board, and one man at 15*s.* a week; also one dairywoman and girl at 17*l.* and board; and about 5 guineas extra in labour was spent in hay and corn harvest; altogether 97*l.* 5*s.* in money, or with board, probably 150*l.* a year, which seems a great deal for 67 acres. It is, as we have said, an outlying farm, with no advantage of access to markets, and with heavy cost of carriage. Mr. Walley has nevertheless bought 3½ tons of bones and superphosphate, and spent a good deal in marling. The purchases of food come to 36*l.* a year, chiefly of India-meal; and 6 qrs. of wheat and 68 qrs. of oats of home growth are consumed on the farm. A good deal of both labour and money has been spent by the tenant in providing water supply to the farm, a good deal also both in marling the land and in new fences. The farm is well managed, and Mr. Walley had perfect right to claim a place in this competition for his occupation; for it is a worthy example of good and industrious management by one who is strictly a native of his place and parish.

Mr. John Gregory, of Waverton, near Chester, a tenant of the Duke of Westminster, occupies 66 acres, of which 18 are permanent grass; the rest being cultivated on a rotation of oats, green crop, and wheat, followed by as many years of grazing as seems desirable. Here, too, is a good example of one born on the place. His family have resided as tenants on the same estate for two hundred years. He milks 22 cows, and, on our first visit, had 6 yearling heifers, and 1 coming three-years-old in-calf. There is a great stock of poultry on the farm, and 35 turkeys, 20 geese, &c., were being prepared for Christmas. Mr. Gregory had made 95 cwt. of cheese that year, which fetched 342*l.*; and he sold 240 lbs. of butter at 1*s.* 3*d.*, fetching 15*l.*; he also sold 40 fat hogs and porkers, fetching 90*l.* Thirteen calves made 42*l.*, 7 heifers and cows, 74*l.* 10*s.* Mr. Gregory purchases about 80*l.* worth of cake and India-meal, and bran for stable use, in the year, and consumes about 50 quarters of home-grown oats. He has generally spent 25*l.* a year in bone-dust and superphosphate. The great features of the farm are the perfect homestead, stone-built, well arranged—due to the land-owner—and the appearance of the stackyard, which is due to the tenant and his sons: the most perfectly built and well-thatched ricks anywhere to be seen. Everything about the place is neat and well arranged.

Mr. C. Catherall, Goosnargh, near Preston, occupies 72 acres,

of which 69 are grass, at a rent of 150*l.*, poor's-rate and tithes amounting also to 18*l.* a year. He purchases about 130*l.* worth of meal and grain for food, and keeps a herd of 21 cows in-milk. There were also 5 two-year-old heifers in-calf on our first visit. We saw also some very good fat hogs. The whole work of the farm is done by himself and son and daughter, employing hardly any other labour besides. His sales of butter and cheese last year came to 338*l.*, besides 6 fat pigs; making altogether 380*l.*, or about 18*l.* per cow; and the calves, selling at 30*s.* apiece, brought the amount up to 400*l.* in all. There are also 3 or 4 cows sold annually, homebred heifers taking their place; but the whole produce of the land cannot much exceed 500*l.* a year; and the rent and manure and purchased food must cost 340*l.*, the remainder being the return for the family labour and the use of capital. It is noteworthy as an instance of work done very much as the colonist has to do in the Prairie, where his next neighbour may be 10 miles away. As we walked round his wide-lying fields, we heard the account from the tenant of how each had been treated. Here was a field which had received 20 cwt. of bones per customary acre twelve years ago, and 5 cwt. per acre of bone-meal since. Three acres laid down by the tenant ten years ago, now rather rushy, had received 10 cwt. of bones per acre; five years ago, another similar field, drained 3 feet deep, 7 yards apart, had received 5 cwt. per acre of bone-dust.

Mr. R. Whalley, at Lodge Farm, Warton, near Blackpool, occupies 66 acres, all grass, nearly all on the alluvial level of that district. Here, too, with the exception of one man at 40*l.* a year, the labour of both stock and land is done by the tenant and his family. He has a herd of 19 capital cows, besides 7 two-year-old and 4 three-year-old heifers in-calf; also yearlings and calves, and a large stock of pigs; 84 cwt. of cheese and 1178 lbs. of butter had been made last year, realising 242*l.* 1*s.* 1*d.* and 80*l.* 3*s.* 7*d.* respectively; and there was a small sale of milk, not more than 15*s.* last year; also 15 pigs had made no less than 79*l.* 15*s.* 8*d.* The receipts amount to 410*l.* 6*s.* 2*d.*, about 21*l.* 12*s.* per cow. He had also sold 3 cows for 63*l.* 15*s.*; and calves, fat stock, &c., had realised 115*l.* The consumption of food, including India corn, oatmeal, &c., amounted to 145*l.* a year, and 70*l.* had been spent on hay and swedes and potatoes. He had spent 119*l.* in five years on various improvements—draining, providing watering-places, roads, tanks, &c.

The last farm in our list in this Class is The Chestnuts, of Ribbleton, near Preston, about 80 acres of good permanent

pasture, lying within the limits of the borough, and occupied by Mr. R. Rigby, who milks upwards of 30 cows. We saw also 10 calving heifers on our first visit in November. He supplies customers in Preston with milk. He pays a rent of 310*l.*; and the borough and water-rates, poor-rate and tithe, bring the whole to rather more than 350*l.* a year. The Chestnuts comes last upon our list, not certainly from any lack of equipment on the part of landowner. We nowhere saw land better fenced with wall and quick, or provided with more costly premises, or better equipped stabling. Large unoccupied buildings had been formerly used as a manure-factory, now abandoned; and in these, shippons for a larger number of cattle than are now kept are provided. A deep cart-shed was noteworthy for its cast-iron pillars, carrying the front eaves, which had beds or slots *cast* on them at regular intervals to carry bars 2 feet, 3 feet 6 inches, and 5 feet from the ground, thus enclosing the interior. The tenant employs large quantities of purchased food. More than 1 cwt. of India meal, and 3 quarters of a cwt. of bran and malt-coombs are used daily, besides $\frac{1}{4}$ cwt. of oatmeal every day in winter; some 4 or 6 bushels of brewers' grains are also consumed daily. He also buys 10 tons of hay and 3 of straw every year. He sells daily 40 quarts of skim-milk at 2*d.*; 100 quarts of whole-milk at 3*d.*, and 40 quarts of strippings at 4*d.* His average sale of butter is about 40 lbs. a week, corresponding to 15 gallons a day, an additional 60 quarts, some of which is accounted for in the quantity of skim-milk sold—a portion of skim-milk being used on the premises. The total produce, 640 quarts, does not seem a very large daily produce from 30 cows, and it must be confessed that we did not find them so good a herd as we had seen elsewhere.

CLASS V.—The class of large stock-breeding farms, one of the most interesting of the whole, included 3 entries: those of Mr. George Ashburner, of Low Hall, Kirkby-in-Furness, Mr. James Tunstall, of St. Michael's-on-the-Wyre, and Mr. Edward Newhouse, of Anclyffe Hall, Slyne, near Lancaster. They have been placed in this order by the Judges.

Low Hall, Kirkby-in-Furness—Mr. Ashburner's farm, the property of the Duke of Devonshire—lies on a part of the western slope of the high land lying between Kirkby and Ulverston, extending up to the heather of the upper mountain, and stretching down almost to the level of the sea—the highest portion some 500 feet above the lowest. It is 470 acres in extent altogether; 204 being mountain and 52 of the remainder being arable. Our visits on three separate occasions to this

farm, amid weather which revealed the magnificent landscape from its upper fields, were a great enjoyment, and it has been a pleasure to look over the notes taken then and the correspondence with the tenant since—a pleasure which we should be glad if the reader could share. The farm itself did not seem on any of these occasions to be in any very special show condition—fences, gates, and fields in merely satisfactory trim. The potato land and turnip land, both in the preparatory stage and afterwards, were evidently being well worked, and promised latterly very satisfactory produce. The grass fields were full of keep; and the land more recently laid down looked like providing ultimately a satisfactory permanent pasture. The oats on the upland fields were as good on our July visit as the comparatively poor and well-washed soil could be expected to produce. The wheat-fields promised a fair crop, and the grass-lands were well grazed, the whole having the appearance of good practical management, without any special attempt at display. And the same may be said of the buildings. The farmhouse, indeed, is remarkably good; the homestead, stone-built and provided with water power, is substantial and useful rather than a model farmery got up for exhibition.

Mr. Ashburner's herd of Shorthorns has achieved a great reputation, and deserves it. Amongst his cows, bulls, heifers, and calves, many examples can be pointed out of success in Showyards: and individual animals could be easily selected well deserving purchase by any one wishing to establish a Shorthorn herd on good original lines and of first-rate constitution. The flock, too, is noteworthy, both for its mountain Herdwicks, and for its Shropshires; which, like the rest of the live-stock on the place, are a credit to the judgment and management of the tenant. The road to the farm from the Kirkby Station passes through hamlets of cottages closely packed, without much attempt at arrangement, with odd spaces therefore in every corner which have been filled as flower-beds, and in summer-time are a delight.

The personal element in the case of Low Hall Farm is of some public interest. The farm was occupied by the late Mr. R. W. Ashburner from 1852 to 1867, and since his death by the son, Mr. George Ashburner. The eldest son is farming in California, the second has farmed near Ulverston and in Gloucestershire, the youngest succeeded his father here. The late Mr. Ashburner's name appears in the 1st vol. of the Shorthorn Herdbook, and there are entries by his sons after him, all being Shorthorn breeders. The late Mr. Ashburner bought his first Shorthorn in Cumberland—a cow called "Lady," bred by "Young Western Comet" (1575), dam by son of "Layton,"

(366), grand dam by "Layton" (366). From this cow innumerable progeny has been bred, and the "Duchesses of Kirkby" and the "Rubies" in the present Low Hall Herd are bred from "Lady." Mr. Ashburner subsequently bought other Shorthorn cows; and since the formation in 1838 of the North Lonsdale Agricultural Society, he and his son have shown Shorthorns every year without a single exception, and they have almost always taken prizes at every Show. Mr. Ashburner, sen., did not give extravagant prices for fashionable blood, but used bulls from one or other of the families he had in his possession. Latterly "Duke of Oxford 10th," and "Oxford" (20,449), the one from Holker and the other one of his own herd, have done good. Mr. Ashburner was noted also in his district as a root grower, advocating wide intervals in the setting out of the swede crop. Since Mr. George Ashburner has succeeded his father, the Shorthorn stock has been increased from 40 to 75 head, and bulls of the Bates' blood have been used, as "Sockburn Lad" (30,024), "Grand Duke of Lightburne 3rd" (2876), "Duke of Oxford" (31,004), "Cherry Duke of Lightburne" (36,349), "Duke of Oxford 41st" (38,174), "Baron Oxford 10th" (42,739), and "Knight of Worcester 6th," out of the herd of Sir Henry Allsopp (now Lord Hindslip), who is in service now. Without specially forcing for show, or even frequently showing, Mr. Ashburner has exhibited not only in his own neighbourhood, but at the Liverpool and Manchester Society and other more distant Shows. He exhibited the "Duchess of Kirkby" and "Florence" at the Royal Agricultural Society's Show at Hull in 1873, taking there the prize for a pair of 3-year-olds; again in 1877, at Liverpool, "Duchess of Kirkby" and her family were second in the Family Class. In 1883, at York, "Bride of Lorne" and her three daughters were Reserve number; and in 1884 "Bride of Lorne" and her three daughters again were shown, and took the first prize for the family.

The history of the farm is noteworthy also in other respects. Mr. Ashburner has taken the prize for "the best stock of cattle, pigs, horses, or sheep, suitable for and adapted to dairy-farms" within the district of the Manchester and Liverpool Society, including both Lancashire and Cheshire. In 1882 the same Society gave him a special prize for the superior management of his farm; and in 1884 they placed him first for the best stock-breeding farm. It is not necessary to attempt the enumeration of the prizes won by animals in the Low Hall Herd. The "Duchess of Kirkby" has won a hundred prizes. The bull "Pure Gold" was also a prize-winner; and the herd itself has supplied stock, especially bulls, all over the country, from Aberdeen to Essex, and across the water to Canada, California, and

South America. Mr. Ashburner is also personally serviceable, not only frequently as a Judge in the Showyards of home and distant Societies, but in every other capacity in which a leading agriculturist is expected to act—as Poor-law Guardian, Churchwarden, &c., &c.; and we submit that the above notes are not only a useful history of persistent continuance in a most serviceable agricultural career, but quite worthy of a record here.

Reverting now to the farm—which lies, as we have said, upon a hill-side facing west, with hanging woods here and there, and general variety of level and of slope—we have to note the advantages it thus possesses in affording sheltered grazing, good pasture-lands, easily worked arable land, and useful low-lying meadows, somewhat scattered one amongst another. The arable land is cultivated generally on the four-field course of cropping: (1) oats; (2) green crops, swedes, mangold-wurzel, potatoes, and carrots; followed by (3) wheat, and that by (4) seeds and clover, kept down as long as may be desired. There were last year 10 acres of wheat; 21 acres of oats, 13 after grass, and 8 after turnips; 3½ acres of mangold-wurzel, and 14 of swedes; 3 of potatoes, half an acre of carrots, 15 of one-year clover, and 16½ of two-year clover; also 39 acres of grass of various ages, which might be ploughed. The rent is 408*l.* a year; tithes and rates come to 40*l.* a year additional. The manures purchased annually generally include 2 tons of superphosphate, and 3 of bone-dust, and perhaps 12*l.* worth of lime. The labour of the farm is done by one cow-man, at 22*s.* a week; 2 carters, at 25*l.* a year, with board; one ordinary labourer, at 25*l.* and board; and one lad, at 10*l.* a year and his board. A woman also, at 16*l.* a year, with her board, is employed in the house; and there are extra hands during hay-harvest; two or three for a few weeks, at 30*s.* to 35*s.* a week at that time with food. The men, it may be said, here, and generally in that country, claim two weeks' holiday in the year; and wages vary with the prosperity of the neighbouring Iron Works. Ten years ago they rose to 36*l.* a year and board, and absorbed nearly all the profits of the farm. The cost altogether—money, wages, and board—amounts to over 300*l.* a year.

Turning now more directly to the farm management—the stock upon the farm in the spring of last year included 30 cows in-calf or milk, with 2 stock bulls; 10 heifers calved in 1883, 11 in 1884, 14 in the spring of 1885; 2 heifers, bought in-calf, 9 grazing cows bought; 5 other heifers, 3 in-calf, and 2 for fattening, and 5 young bulls; total 88. The sheep stock included 23 Shropshire ewes, 22 of which had 35 lambs; 59 half-bred ewes, 47 of which had produced 72 lambs; 42 Herdwick ewes, most of which had still to lamb; 3 tups, 11 half-

bred ewe hoggs, 5 Shropshire hoggs, and 41 hoggs, fat or fattening—184 sheep, and 123 lambs at that time. There were 6 working horses of the farm, two of them breeding mares, of which one had foaled, and one was to foal, besides harness mare, a pony, and several colts.

The annual produce of the farm includes 2800 lbs. of butter, selling at 1*s.* 4*d.* per lb.; a certain quantity of milk, about 10*s.* a week; and 4 or 5 fat pigs. There is also a considerable sale, especially of breeding stock, but also of fat stock, during the year. Six cows had been sold at an average price of 57*l.* 3*s.* 4*d.*; 4 heifers at an average price of 29*l.* 3*s.* 4*d.*; 19 fat cattle, young and old calves, and full grown, had realised 311*l.* 7*s.*; 5 young bulls, 129*l.* 19*s.*; 140 sheep, 289*l.* 10*s.*; wool, 34*l.*; and 2 horses at 40*l.* apiece. The other sales include comparatively small quantities of wheat and oats and potatoes and poultry.

Mr. Ashburner gets a ready market for all his bulls.

Among the items deserving record in farm management we give the following detail of the seeding of 10 acres of permanent grass-land (the field is of a comparatively light soil): 4 bushels of Italian rye-grass, 6 bushels of perennial rye-grass, 14 lbs. of foreign cocksfoot-grass, 15 lbs. of alsike clover, 20 lbs. of English white clover, 25 lbs. of "true Welsh" red clover, 15 lbs. of cow-grass, 12 lbs. of trefoil, 14 lbs. of Timothy, 14 lbs. of sheep's fescue, and 6 lbs. also of rib-grass. The young grass is fed during the first autumn, pastured next year, receives a dressing of farmyard-manure in either the first or second winter, and 5 cwt. of bone-manure in the second or third winter.—We quote also from our notes Mr. Ashburner's account of calf management. The calf is taken at once from the mother and receives new milk daily, as much as it will take till 2 months old—if a bull, till 3 or 4 months old: and if a heifer, after the second month, skim-milk is used, supplemented with linseed-meal or wheat flour. Calves are turned out at the end of May, the young stock getting cake in the field. Every change of course in the diet and other management comes gradually. They are brought in at night in the autumn and winter, getting a few swedes and chaff and hay, and "anything that needs it gets it."

Going through the fields on our last visit we found clover and grass, grazed after oats, very full of food. On half of it, however, the seed had missed, and it had been resown with rape and rye-grass—5 lbs. of rape and half a bushel of rye-grass—to serve for winter food, and the whole will then be brought in for oats next year. The wheat field, a fair crop, had received half a ton per acre of Webb's wheat manure on that part of it which had been after potatoes. The potato crop receives a heavy

dressing of farmyard-manure, the mangold-wurzel a full dressing of farm manure and 2 or 3 cwt. per acre of Webb's mangold manure; swedes, of which the seed is obtained from Messrs. Little and Ballantyne, receive farm manure, or, in the absence of that, 5 cwt. of bone superphosphate; and the testimony here is, that after farm manure the crop is not so good as after the artificial, nor generally quite so sound.

Mr. James Tunstall, in the parish of St. Michael's-on-Wyre, near Garstang, occupies 342 acres, of which 130 are the property of Lord Derby, and 162 the property of the executors of the late Colonel Butler, and 50 are his own property. He has been here for thirty years, a breeder of good Shorthorn cattle all that time, always using well-chosen bulls of good blood. His cow-stock, as a whole, are as fine a looking herd as any we saw in the course of our inspection. A very handsome roan bull has latterly been in service, of the Rev. P. Graham's breeding—bought from a neighbour who had used him for a year, and then parted with him for 40*l.* Mr. Tunstall rears all his calves, selling them either as breeding stock or fattened. His bull-calves often fetch 20*l.* or 30*l.* apiece from neighbours. They are sold chiefly in the neighbourhood, where they are known. It is an example of a herd where a really admirable pedigree exists, whether it can now be set down on paper or not; his stock must all have been eligible for the Herd-book for many generations, and a very admirable stock they are. The land is much of it a heavyish soil—some of it alluvial, of good quality—a good deal is a black soil on peat, but lately brought into cultivation. Of the 227 acres, 81 are arable, and at present in green or grain-crops; 56 are grass or clover in rotation, and the rest is permanent pasture. The cropping last year included 26 acres of wheat, 26 acres of oats, 5 acres of swedes, 24 of potatoes, with 18 acres of one year's clover, and 38 acres of other grass, which may be ploughed. The usual rotation is oats, beans, potatoes, wheat, clover. About 200*l.* is spent annually on various manures—boiled bones, superphosphate, and guano. The clovers always receive a dressing of bones, as also at intervals does the whole of the grass-land. The dressing for the potato-crop is usually 15 tons of manure, and 5 cwt. of bones. The labour of the farm is done by two team-men, receiving 28*l.* and board; two day-labourers, at 18*s.* a week, "with a bit of food at busy times"; two ordinary men, who get 8*s.* a week and board; and one dairy-girl at 12*l.* a-year, with her board. When extra milkers are wanted, they receive 3*d.* a meal. About 100*l.* is spent annually in cake and meal, and a good deal of home-grown corn is fed. The premises are all

that can be desired; well-arranged, stone-built, and substantial; a capital barn, with eight-horse power engine; shippons, three-stall stable with tallet for hay overhead; good waggon-house; ample shedding; and a modest farm-house. Mr. Tunstall tells us that formerly the land lay in many small farms, which have now been thrown together. The appearance of the green crops in July was very satisfactory. Webb's Challenge White Wheat was a nice crop after turnips and potatoes, young clover coming up among it; and there was a fine crop of beans after oats coming after clover. On the peaty soil the crops were uneven. Potatoes, however, on that soil after oats after clover, promised to be a very good crop, the result of the heavy dressing of manure that they received; the seeds after wheat which had been laid were a very uneven crop. The access to these fields, and, excepting the public roads, to other fields on the farm, were by good roads of the tenant's own making; a mile or more had been at his own cost. He milks generally 20 cows, and rears, as we said, all the produce; bringing in heifers, and sometimes the older cows, to the pail in the autumn months, when they are saleable for winter milk; and fattening the steers and selling them, and such as he keeps as bulls, at good prices. His make of cheese was less than 4 cwt. per cow, and it was not of first-rate quality. No butter is made off the whey, the pigs receiving it as it leaves the cheese-tub; but a little butter is taken off the evening's milk, especially towards the end of the season. The cheese had been sold in 1884 at 64*s.* per cwt.

Besides the cow-stock, which, as we have said, is remarkably good, Mr. Tunstall has a small flock of half-bred Teeswater and North ewes of good quality; 40 lambs had been sold the previous year at 25*s.* apiece in August. Six or seven pigs, of a good breed, are fattened annually. The farm is worked by seven horses (two of them breeding-mares), and there is one nag-mare. Mr. Tunstall is well known as a breeder of good stock, and is in request as a judge of Shorthorns within his county. His farm is a thoroughly well-equipped and well-cultivated area of land, made to yield its utmost, whether in permanent grass or clover, or arable crops. His stock is thoroughly good, and he deserves the second place in this competition.

Mr. Edward Newhouse, farmer at Anclyffe Hall, in the parish of Slyne, about three miles north of Lancaster, occupies 186 acres of land, of which 35 are arable, the property of H. L. Gaskell, Esq., Kiddington Hall, Oxford. The soil is generally somewhat heavy, on a marly subsoil. The stone-built house and premises stand in the midst of the land, which lies in big 10 to 18-acre fields around it—partly above it and exposed—

partly below it and sheltered by belts and wooded banks, with many large trees bearing witness, as the crops do, to the quality of the soil. Most of the land was arable when the late Mr. Newhouse took it twenty-five years ago, and it has been laid down during the tenancy since. The rent, 340*l.*, with 63*l.* in tithe, rates, land-tax, road rates, &c., amounts to over 400*l.* a year, or 43*s.* an acre. The farm is strictly a stock-breeding farm, having unquestionable right to its place in this class. Twenty-five cows generally are milked, and on our first visit we saw 7 heifers in-calf coming three years old, 12 yearling heifers, 11 heifer calves, 9 steers, and 2 bull calves; also 1 yearling Shorthorn bull just bought for 30 guineas. The sheep stock include 80 ewes—56 half-breds by a Leicester ram out of black-faced ewes, and 24 of the large, hardy, longwool Wensleydale breed. There were also 32 lambs, 2 rams, and 6 feeding sheep still on the farm in November. Ninety lambs had been sold at 35*s.* apiece, and 6 ram lambs at from 55*s.* to 60*s.* apiece. Ten Wensleydale rams had also been sold at 5*l.* apiece. The other stock included 3 good white sows (middle breed), 2 of them with 15 pigs, and 1 in-farrow, and 1 fat hog; and there was plenty of poultry about. It is plain that Anclyffe Hall is distinctly a stock-breeding farm; stock indeed, not only in quantity but in quality, for the cow stock were generally of a fair Shorthorn quality; two polled cattle, however, not the worst milkers, being amongst them. On our second visit we saw many which were then yielding 10 quarts of milk at a meal. The food consumed during the year included 180*l.* spent in bean and pea and India meal, and in linseed and decorticated cotton-cake; also all the oats grown upon the farm. Mr. Newhouse sells a certain quantity of milk, generally 13 gallons a day, at 9*d.* a gallon, delivered in Lancaster. His sale of milk amounted last year to 176*l.* 5*s.*; his butter sales to 130*l.* a year, being 2080 lbs. at 1*s.* 3*d.* He also sold 5 fat cows at an average price of 23*l.*, 4 fat cattle at an average price of 26*l.*, 3 heifers at 17*l.*, 13 bullocks at 8*l.* and 11*l.* each, and 2 young bulls at 20*l.* and 21*l.* His calves receive new milk for a month, and then skim-milk with Bibby's meal. The other sales upon the farm amount to 60*l.* or 70*l.* worth of wheat, seed oats, and potatoes. The labour is accomplished by 3 horses and a nag. A foal is bred annually, and we saw one three-year-old colt, one yearling, and a foal. All the men are boarded and lodged in the house, including one carter at 26*l.*, one cowman at 25*l.*, one day labourer at 26*l.*, one dairywoman at 19*l.*, one girl and one boy at 9*l.* and 5*l.* respectively; and 5*l.* or thereabouts is spent extra at harvest time. The money expended in wages thus comes to 115*l.*, but the board of so many must cost at

least 120*l.* more. The master also shares in the work, taking his part in the milking along with the others. The day begins about 4.30 A.M., followed by milking at 5, breakfast of oatmeal porridge and bread and butter at 6.30, dinner at half-past 11—meat, potatoes, and beer—tea, with bread and butter, at half-past 3, and supper, at 6, of potatoes and meat, or porridge, or bread and cheese. The second milking is done at 5 P.M.

On the arable land the rotation usually followed is wheat, followed by two years in seeds, broken up for oats, and followed up by swedish turnips, a few mangolds and an acre of potatoes. Webb's Challenge Wheat, Early Angus Scotch Oat, Sutton's Champion swede, and Sutton's two years' mixture of clover and grass, are the seeds employed. The manures purchased during the year include generally 3 tons of bone manure at 8*l.*, 5 tons of bone-dust at 9*l.*; and some lime, perhaps 12 tons, carted two miles, and costing 6*l.* 12*s.*, composted with earth, and applied on the stubbles at the rate of 20*s.* an acre.

Walking over the land in April, there was a fairly good wheat plant, a fair promise of seeds; the fallows to receive the green crop were not very clean, nor the ploughing well done. In July the seeds mown had been a fine crop, wheat and oats both looked well, and the turnip crop late, but in good condition. The pastures had a fair quantity of food in them of good quality, but the thistles had certainly been allowed to stand longer than is desirable. The seeds are manured on the wheat much stubble. Tank stuff with farmyard-manure is applied at the end of the following year. They are fed the first year and mown the second.

The buildings, arranged on three sides of a square, include ample shippons for cows, and loose-boxes for calves, a 7-stalled stable, piggeries, large loose-boxes, &c., with an uncovered manure stance in the middle. Mr. Newhouse deserves a high commendation for the quantity of stock of all kinds kept on his farm, for the general economy of his farm labour; and for his ability to make ends meet on a highly-rented occupation.

CLASS VI.—In this Class—Stockbreeding Farms under 100 acres—there is but one entry, that of Mr. John Cottam, who occupies Well House Farm, 98 acres in extent, the property of J. Colston, Esq., of Bolton-le-Sands, 94½ being permanent grass and 3½ acres arable. We saw here a capital herd of 20 Shorthorn cows and 8 two-year-old heifers, some of them in-milk or in-calf; and some of these as good as any we had seen anywhere. There were also 19 yearling cattle, a small flock of sheep—52 ewes with their lambs—and a considerable

pig stock; so that the place comes clearly within the class of stock farms in which it is entered. Mr. Cottam sold last year 12,775 gallons of milk for 638*l.* 15*s.*, and 1300 lbs. of butter for 92*l.* 1*s.* 8*d.* He also sold pig stock to the amount of 26*l.* 18*s.* His sales also included 5 calving cows at 125*l.*, 7 fat cattle at 22*l.* = 154*l.*, 10 young calves at 50*s.* = 25*l.*, and 5 fat calves at 4*l.* 10*s.* = 22*l.* 10*s.*; 3 young bulls at 14*l.* = 42*l.*; 85 ewes and lambs at 2*l.* = 170*l.*: or in all 1296*l.* 4*s.* 8*d.* Sales to the amount of 13*l.* per acre off grass-land is a remarkable performance. His purchases included five cows for 110*l.*; 10 young grazing beasts, 70*l.* His purchases of food amounted to 297*l.* 12*s.* 11*d.* for linseed-cake, oat- and pea- or India-meal, and brewers' grains; also 18 tons of hay = 78*l.*, and 6 of straw = 13*l.* 6*s.* 8*d.* His purchases of manure amount to about 84*l.* 5*s.* a year, namely, 100 tons of stable manure, and 5½ tons of bone-dust. The labour of the farm is done by three men, one dairywoman, beside his own sons; and about 12*l.* for occasional extra labour. The farm lies in the valley, part of it on the lower level, a highway dividing the lower area from a double row of fields on the rising ground. The small arable field, of a somewhat heavy soil, yields oats, beans, and potatoes; and there is a sale generally of 20*l.* worth of potatoes: but all the rest of the home produce is consumed upon the farm. It is a well-managed occupation, carrying a large quantity of stock, cattle, sheep, and pigs, the former producing not only about 27*l.* worth of milk and butter apiece in the year, but rearing calves; a considerable number of young stock being reared on the premises. Thus coming clearly within the terms of the Class as a stock-breeding farm, it fairly deserves the prize which has been awarded to it.

Class VII.—This included such farms as, being under 40 acres in extent, were worked for the most part by the tenant himself and his family. We have had no difficulty whatever in awarding the first prize here to Mr. Wm. Loxham, who farms 29 acres within a mile of Leyland Station, 5 miles south of Preston, the property of the Rev. Prebendary Michell, of Wells. Of this, 26 acres are ploughed, and 3 acres permanent pasture. Mr. Loxham has occupied this farm for twenty-seven years, paying a rent of 64*l.* a-year from the beginning, when, as he represented to us, it was an unenclosed area but lately recovered from the moss, divided only by ditches; with, however, a substantial cottage home and sufficient outbuildings on it. He now pays 69*l.* 5*s.* a-year; or, with tithe, 4*l.* 13*s.* 8*d.*; poor's rate, 3*l.* 12*s.* 4*d.*; road rate, 1*l.* 18*s.* 8*d.*; in all, 79*l.* 9*s.* 8*d.*, equal to 2*l.* 14*s.* 9*d.* per acre. During his tenancy he has drained the whole land 3 ft.

deep, 8 yds. apart, the landlord finding the tiles. He has planted $1\frac{1}{2}$ miles of new fences, the landlord finding the quicks. He has also drained and filled in 1400 yards of ditches, the landlord finding tiles. It will be seen that this is a case where the tenant was willing to give an enormous rent in the outset, which has not been materially increased by the owner on the tenant's improvements. But how it can have been worth its original rent thirty years ago is hard to understand. It has certainly been very materially enhanced in value during Mr. Loxham's tenancy. The farm is in perfect order; the quick fences, all his own growth, are so many narrow walls of green, perfectly clean beneath, with deep ditch alongside, into which the subsoil-drains deliver. The land is divided into seven fields, one of them a grass-field of 3 acres near the premises; and there is a garden and orchard by the house. There is access by a good road to the farther fields; and there is a small outlying piece a quarter of a mile away. The farm-work of the farm is done by himself, a son just rising into manhood, two daughters, and a hired man at 3*s.* a day for three months at harvest time. One farm horse, a good thick mare, is worked, and another is hired for a couple of weeks at busy times. Horse hire cost 22*s.* last year. The buildings include barn, cow-shed for four cows with gangway. 2-stall stable with hay place, cart shed with loose-box and granary over; and a Dutch barn for hay, 30 ft. by 18 and 15 ft. high, has been built by the tenant. There is a substantial somewhat low-roofed farmhouse with sufficient outbuildings. The stock on our first visit included two cows, a white heifer, 2-year-old, in-calf, and a heifer calf; also a young bull, which is kept for the accommodation of the neighbours. There were six capital long white pigs in the stye which had been bought for 33*s.* three months before, and then weighed probably ten score apiece. Of these, twelve are fed every year up to 20 st. apiece; and there is about thirty head of poultry. The cows are remarkably well bred and selected. Two large-framed extraordinary milk-producing machines were being milked three and even four times a day in the early months after calving, and 90 lbs. of butter were being sold in May and June. One of the cows had been dry a month before calving, the other had been milked night and morning up till calving during the previous three years. One of these cows had been down with milk-fever in the spring of last year at her last calving, but had happily recovered. The food bought for this stock is about a pack, equal to 240 lbs. of Indian corn or meal weekly, of which 70 lbs. goes to the horse, and as much as 140 lbs. to the cow stock and pigs. When in full milk they were receiving last July 7 lbs. apiece of Indian meal daily, grazing in the 3-acre piece of grass; and this, with the hay from off the clover field, whether one two

years old, mown twice; also the small potatoes and the swedes and mangolds planted in the intervals of the garden; also every bit of grass that could be mown, whether in orchard or paddock or by hedgerow, made up the food-supply of the year. Every economy is practised in order to the maintenance of a most liberal system. The garden and orchard planted by the tenant bear equal testimony with the farm to his industry and energy. Gooseberry bushes planted 5 ft. by 4 ft., with potatoes between the rows, and turnips or mangolds between the trees, yield a crop of "Lancashire lads" or "Crown bobs," which are sold in Liverpool at from 1*s.* to 2*s.* a dozen (= 21) lbs.. And it may be here mentioned that Mr. Loxham, a quiet laborious home-keeping man, does not attend markets himself, but sells everything to dealers who come for it. Probably, in this way, he loses a certain amount of profit; but in a small business like this, where his own is nearly the whole labour of the farm, he is probably right to do his marketing by another. A considerable revenue is derived from both garden and orchard produce—white codling apples, pears, cherries, damsons, planted 15 ft square, are fairly productive. Before leaving the house we may mention that the milk not set for cream is churned whole three times a week, the butter-milk going to the pigs and to the calves. The calves receives whole-milk for two weeks, which is gradually changed to butter-milk with about 1 lb. of Indian meal apiece, and they have to fight through their difficulties of inevitable diarrhœa as best they can; generally succeeding, it seems, in the end, and probably benefiting by the fact that only one or two have to be attended to and cared for by the mistress.

We hope the reader has got the general impression of this farm as a level area, stretching from the road in a somewhat narrow-oblong, divided by the thinnest and trimmest of fences into fields of 3 to 5 acres each. The low-roofed farmhouse and little homestead are reached by a short offset from the main thoroughfare, with gates at the roadside. The land is now a blackish soil of sufficient substance, originally moss, and its subsoil of clay is nearer the surface than it used to be. Walking round the fields we see that the rotation is potatoes, wheat, clover, kept perhaps a second year, and then ploughed up for potatoes—first a very shallow furrow in the autumn, but cross-ploughed in the spring 7 or 8 inches deep; "Magnums" are chiefly grown, changed every other year—a finer piece was never grown than we saw last July. A plot was shown us in the outlying field of potatoes, clearly proving the great importance of a change of "seed." The land planted with the home-grown sets in the midst of that which had been grown from sets sent from Cumberland was very shabby indeed in comparison. Going round the fields in July we found a magnificent promise of

potatoes, a very fine show of wheat, a local white sort, the seed being sown broadcast over the dug potato land and ploughed in, the "seeds" sown amongst it looked well: 8 lbs. of red clover and 3 lbs. of alsike clover, and 3 lbs. of trefoil, and 1 peck of Italian rye-grass are sown per statute acre. This we got by calculation from the terms in which Mr. Loxham reported the matter to us—the local acre being quoted. We were told that the produce of a poor crop of wheat last year off $4\frac{1}{2}$ Leyland acres amounted to 54 windles, sold in Preston at 14*s.* 6*d.* a windle; which, being interpreted, means that $4\frac{1}{2}$ times 160 rods of $7\frac{1}{2}$ yards to the rod had produced 54 times 220 lbs. of marketable grain; and the necessary arithmetic being still further applied, we get out that about $8\frac{1}{4}$ statute acres had produced $191\frac{1}{2}$ bushels of 62 lbs. a bushel—not a very heavy crop. The manure bought annually on this farm includes a quantity of horse-dung from Blackburn, costing 9*s.* a ton at the station one mile off; one ton of Rochdale Corporation manure, at 6*l.* 15*s.*; and 5 cwt. of Wigan manure, at 11*l.* a ton. All this is put upon the clover, which is mown twice. The current crop of wheat looked more like 40 bushels per acre than 20. The clover mown had yielded a capital rick of hay, already in the Dutch barn. We here see an example of a family brought up in a quiet homely industry, where probably not only a living has been made for all, but a certain amount of profit has been accumulating annually. Mr. Loxham distinctly deserves the first place in his class.

The second prize in this class is given, after some doubt, to Mrs. Margaret Park, of Cropper Farm, Little Marton, Blackpool. There are here 16 acres of plough-land, and 12 acres of permanent grass—part of the Clifton Estate. Most of the arable land is a black soil, on the level of the original moss—the pasture, on a somewhat higher level, is useful grass-land. This holding is thus distinctly of the same class as Mr. Loxham's farm just described; and it also comes within the class as regards its labour—a son and daughter doing most of the work, with, however, one additional labourer receiving 15*l.* a year and his board. More stock is kept than on the Leyland farm. Five cows are milked, and we saw one heifer and two calves, also a small flock of sheep (19 lambs had been sold), one farm mare (her last foal had been sold for 20*l.*), and four pigs in the stye: no poultry was kept. Mrs. Park was sending 30 lbs. of butter weekly to Blackpool in July, receiving 1*s.* 2*d.* a pound. Her other sales annually included calves, the produce of the small flock, an occasional fat cow, a foal, a good deal of fat pork, and the produce of the oat and potato fields. She pays a rent of 65*l.* a year, with 7*l.* 14*s.* additional for tithes and rates.

Fifty shillings an acre seems a heavy rent; but the little farm has been well equipped; both house and buildings being apparently beyond the need of so small a holding. Bone-manure is bought occasionally, and a ton of artificial manure is bought annually for swedes and potatoes. The other purchases include a pack (240 lbs.) of India meal weekly when cows and pigs are both in full profit. The farm looked very unpromising on our first visit, and did not look like having a place in the competition at all; but we found it greatly improved in July. Potatoes—Champions, Reading Heroes, Magnums—looked very promising: oats (Polands) were a heavy crop. Good crops of hay, both on the clover and the old land, had been well won. Swedes (Webb's Imperial) and mangolds looked well; and the garden was most productive.

The third prize in this class is awarded to Mr. Joseph Gibbins, who holds 14½ acres of black soil, originally moss, in the parish of Culcheth, four miles north of Warrington, the property of Mr. W. Hinmers, of Eccles. He pays 50*l*. a year as a tenant-at-will. There is a fairly good house with barn and stabling by the roadside, from which you see in the month of May the most perfect growth of early cabbages fit for market, and in the autumn the most admirable growth of celery. It is, in fact, as regards the chief receipts from its cultivation, a market garden, not a farm. Mr. Gibbins generally grows 3 acres of celery, followed by early cabbages, with a further crop of potatoes dibbled in their midst, 4 acres also of potatoes preceding the celery and other crops. There are also 3 acres of oats, 2 acres of clover or rye-grass, and some 2 acres of peas, turnips, &c. If any one wants to know how to grow celery and early cabbages, this is the place to teach him. The area devoted to these crops furnishes the chief revenue of the farm, and is perfectly and successfully managed to that end. The rest of the land is not so well done. With the immense quantity of manure purchased, there is, of course, an enormous growth of everything, and weeds as well as cultivated plants abound; and the outlying portions of the little farm were far from clean. And this, together with the impression arising out of the terms and conditions of the competition, which refer to farming rather than to gardening, led to Mr. Gibbins being placed no higher on our list. He was not indeed without stock on the farm. We saw a very useful cow, six fat pigs, and a good farm mare on our first visit. This holding is an example not only of successful cultivation but of constant labour. Mr. Gibbins and his wife, and a lad and one grown son during the summer months, also one man nine months in the year at 14*s*. a week with food, do all the labour, working from dawn till sunset

during the busy time. Celery plants are reared in carefully protected beds, and pricked out 8 inches apart, in rows 5 feet apart, and ultimately sold at 1*s.* 9*d.* to 2*s.* a dozen. This is followed by cabbages, planted as soon as the land can be got ready after the celery. The cabbages, receiving 5 cwt. of nitrate per acre in March and April, are ready for sale in May at 9*d.* a dozen. A late potato is dibbled in between these cabbages in April, and a crop of 6 to 8 tons may be dug in the autumn. Here therefore, in two years, off one acre may be realised from more than 1000 dozen of celery, 50*l.*, and from 1200 dozen of cabbages, 45*l.*, and from 6 to 8 tons of potatoes, 15*l.* —110*l.* in all. This, of course, is only the possible return; but actually between 40*l.* and 50*l.* worth of produce may thus be generally obtained per acre. The expense, of course, is very great. The celery receives 50 tons of dung per acre, in furrows drawn 5 feet apart, in the deeply ploughed garden-mould, as it has long since become. Over this, covered by the plough, the plants are pricked out 8 inches apart, and gradually banked up, as they grow to a great size, weighing ultimately about 6 lbs. per plant. The purchases of manure include horse manure, 160 to 200 tons a year, from Farnworth and Bolton, 14 miles away, where the celery and cabbage crop is sent; and 40 to 50 tons of shoddy from Oldham, delivered at the railway station near: 25 cwt. of nitre, too, is bought every year. The celery, which receives most of it, comes once in every three years—a portion of altogether new land being also occasionally brought into use as the demand for the crop grows. It follows potatoes—"Magnums," which have received a "light dressing" of 15 tons of dung per acre—and it is followed, as we have said, by cabbages and potatoes; so that the land is worked very heavily. And considering that 200*l.* a year is said to be spent in manure, the "farm," for which 50*l.* a year is paid in rent, is a mere factory for converting purchased raw material into celery, cabbages, and potatoes. There is a certain quantity also of land, as we have said, in oats and clover, peas and beans, and swedes and mangolds; but the only noteworthy feature is the market-gardening, which we have described. Mr. Gibbins has lived on this farm for six years. His father and brother held it for twenty-seven years previously. He has drained the whole of it the last three years, 3 feet deep and 5 yards apart, the landlord finding the tiles. He has also taken out 700 yards of old fences and planted 500 yards of new.

The leading feature of the agriculture which this Report describes—viz. the extraordinary development of land value at their own risk by yearly tenants—thus receives probably its most extraordinary illustration in this, the last farm on the list of twenty-two to which reference has been made.

It may be well to point out to any reader who may have pursued our figures to their conclusions in balance-sheets of his own arrangement, relating to the several farms herein described, that the prices of the years referred to have been altogether exceptional. It is not more remarkable that some Cheshire farmers should have been able to make extraordinary incomes when cheese sold at 70*s.* a cwt. than that others should be able to live at all and pay a rent, when by either misfortune or mismanagement their cheese realises, as it often does, not much more than half as much.

We cannot close our Report without again thanking each and all of the competitors for the facilities afforded us in obtaining the necessary information; and also for their great kindness and hospitality on every occasion when we had to visit their farms.

THOMAS NUTTALL.
SAMUEL ROWLANDSON.
J. CHALMERS MORTON.

V.—*Farming and Agricultural Training in Reformatory and Industrial Schools, with Notes on Spade-labour.* By H. M. JENKINS, F.G.S., Secretary of the Society and Editor of the 'Journal.'

IN my Report on Agricultural Education to the Royal Commission on Technical Instruction * (p. 315), I remarked that at the present time there exists no machinery in Great Britain for the technical instruction of the sons of small farmers or farm-bailiffs, or of other lads who desire to follow one or other of those callings; and I suggested the establishment of Farm-schools, more or less on the French model, for the purpose of supplying this deficiency. I assumed that a small farmer or farm-bailiff would "keep his son at school until he is at least fourteen years of age, and would then be willing to apprentice him to a large farmer, if he could see clearly that it would be to the boy's advantage—the small value of the boy's labour not being of immense importance in consideration of the fact that the keep of a lad of that age, if he is strong and healthy, is almost certain to cost as much as he is likely to earn."

The details of my plan were briefly: "That in each county there should be selected a good farm, the tenant of which would agree under certain terms to take agricultural apprentices for a

* 'Second Report of the Royal Commissioners on Technical Instruction,' vol. ii., 1884. [C—3981.—I.]

term of, say, two or three years, according to the age at which the apprenticeship commenced. . . . It would be a great advantage if to each farm there could be attached a teacher capable of continuing the general education of the apprentices, by lessons given in the mornings and evenings, but the remainder of whose time might be otherwise employed. . . . He should be capable of teaching the elements of chemistry, land-surveying, book-keeping in a simple way, and the elementary principles of agriculture. Most of this technical instruction could be given during the winter evenings, and the apprentices should be entitled to pass the examinations of the Science and Art Department in the same way as pupils of science classes, if they desired to do so, and to earn for themselves and their instructors all the distinctions and rewards that are given to pupils and teachers in elementary schools and science classes. . . . The apprentices should be selected from those who distinguish themselves most in an examination held annually in connection with that of the Science and Art Department."

To enable the sons of farm-labourers and farm-bailiffs, who obtain all their education at elementary schools in rural districts, to obtain technical as well as general instruction, I recommended several alterations in the schedules which had then been recently issued, and also the addition of practical work on the land to the school curriculum. By these means I thought that it would be possible to silence the complaints of farmers that the education given to farm-labourers' sons in rural districts seems designed to unfit them for an agricultural career. In other words, while, on the one hand, farmers assert that they are compelled to pay for such an education being given to their labourers' sons as unfits them for country life, and induces them to emigrate to the towns,—thus making farm-labour more scarce, more dear, and less effective,—on the other hand, the town-labourers exclaim that they are being ruined by the influx of cheap country labour.

This is still the position of these two divisions of the great subject of Agricultural Education in this country. Some people doubt the possibility and others doubt the desirability of combining technical with general instruction. The success of this plan in other countries is met by the stock argument, rarely stated, but generally the pith of what is said, "Englishmen are not as other men are."

Having obtained the permission of the Council of the Society to visit and report upon some of the Reformatory and Industrial Schools to which agricultural land is attached, I addressed, in the first place, a schedule of questions to the authorities of those schools in England and Wales, where, according to the Annual Reports of Her Majesty's Inspector,

agricultural labour seemed to hold a prominent place. Secondly, I visited all those schools from the authorities of which I received replies to my questions, namely, eighteen Reformatory and eight Industrial Schools, having attached to them a total of 1831 acres of land in the former case, and of 654 in the latter. By these means I trust that I have been able to throw some light upon the question of the combination of general with technical instruction in schools where the general education is of an elementary character. Admitting the necessary separation of the two classes of instruction in our High Schools and Universities, I believe that the sons of farm-labourers, farm-bailiffs, and even small farmers—whose school-life is necessarily of very limited duration,—may be usefully instructed in farm-practice and in the elements of the agricultural sciences without detriment to the efficiency of their general education; and the evidence given in the following pages by the authorities of Reformatory and Industrial Schools entirely supports this view, in spite of the fact that they (especially the former) have to deal with the most unpromising raw material that one can imagine.

It is gratifying to remark that gentlemen interested in the success of Reformatory and Industrial Schools have found in my Report to the Royal Commission on Technical Instruction material which they deem worthy of consideration from their point of view, and thus it seems that we have placed each other under mutual obligations. The first of these papers which came under my observation was a very thoughtfully constructed essay on "Technical Education" by my friend Mr. John Bowden, Head Master of the Boys' Farm Home, East Barnet;* it was published in two instalments in 'The Reformatory and Refuge Journal' for January to March, 1885. The second was a very interesting and able paper read by Capt. Legard at York last June,† in which the author remarked, after referring to the Continental Farm-schools, "Now it will be observed that in our Reformatory Schools, conducted on the "Farm System" we have precisely that control over a child's education at a critical period of his life, viz., from twelve to fourteen, which we lose in our Elementary Schools. I think the experience we have gained in our Reformatories, and the results attained, should help much to guide us in adopting any system in our Elementary and Secondary system of Education. We have here to deal with the least promising class of the community, but the results have been extraordinary." He added: "Our educational system, especially in rural districts, is not doing all that was

* A notice of this school is given on pp. 210, 211.

† 'Report of the Third Conference of the National Association of Certified Reformatory and Industrial Schools,' pp. 53 *et seq.*

expected of it. The children of the agricultural community are not entering life at the age of manhood and womanhood with a thorough knowledge even of those subjects which they have been taught at school. Their secondary education, which should provide them with that technical knowledge which is almost a necessity for success in business, is absolutely neglected." Capt. Legard further "hinted that our Reformatory Farm Schools may afford us practical experience as to results." This paper was read at a time when I was busily engaged in collecting the evidence of this "practical experience as to results," which I give in the following pages, and which entirely bears out Capt. Legard's supposition.

As the question of cultivating land by means of spade-labour is now attracting general attention, I have taken the opportunity which this investigation has afforded me, to bring into relief the results obtained by that system at each of the schools reported upon. I have also endeavoured to indicate the causes of some of the most pronounced differences in these results, such as proximity or remoteness of markets, favourable or unfavourable climates, variations in soil, and any other circumstances that seemed to influence them.

LIST OF QUESTIONS?

1. What is the name of the School?

2. Is it a Reformatory or an Industrial School, and under what Act of Parliament are its operations conducted?

3. What is the average number of boys or girls maintained at the School?

4. Please give what information is possible in general terms as to their ages on entering and leaving the School, also as to their past history and future careers?

5. To what extent is the practice of agricultural operations used as a means of instruction, physical exercise, or recreation, with details of the scheme of payment or other remuneration to School-inmates employed in farm-labour? If plots of garden ground are given to the boys as a reward for good behaviour, or as an incentive, please give information under that head.

6. Please give a detailed account of the management of the land attached to the School under the following heads;—

(*a*) Area of permanent grass land.
(*b*) Area of arable land.
(*c*) Area of garden land.
(*d*) Rent under the above heads.
(*e*) Payments for labour on the farm and garden, under the following heads:—
  Payments or bonuses to inmates.
  Payments to ordinary labourers.
  Payments to bailiffs or other superintendents.
(*f*) Method of farm-management adopted, including rotation of cropping.
(*g*) Number of horses, cattle, sheep, pigs, and poultry kept on the farm.

(*h*) Value of the live-stock and produce sold off the farm and of that utilised for School purposes, giving definitely the actual quantities and prices in each case.

(*i*) Nature and suitability of farm-buildings.

7. Please give any information or opinions that you may possess on the general question of the adaptability of farm-labour to the general purposes of an Industrial or Reformatory School, especially under the two main objects in view, namely:—

(*a*) As a means of influencing the mind in a right direction.

(*b*) As a means of technical instruction with a view to future advancement in life.

8. In the event of a working dairy being attached to the School, please give any details as to the means of instruction in dairy operations that have been adopted, and any results therefrom that may have been observed.

9. Please give information on any special feature of the farm-work, and on any other points not included in the foregoing questions. (For instance, outside employment and what may be termed agricultural manufactures, such as milling.)

10. Please state the conclusions at which you have arrived with regard to the extent to which elementary education suffers (if at all) in such schools as yours by its combination with practical work, in comparison with the results obtained at ordinary Board Schools.

Origin of Reformatories and Industrial Schools.

It will not be necessary to go deeply into this part of the subject, but some reference to it is desirable for the purpose of showing how successful has been, in the case of these institutions, the combination of personal, local, and Imperial aids.*

In the last Report which was written by the Rev. Sydney Turner, who had been Her Majesty's Inspector for nineteen years, an interesting memoir on the origin and history of the schools is given; and the following statement is a very condensed abstract of the chief points referred to:—

The "Philanthropic Society" for the protection of the children of convicts and the "Refuge for the Destitute" had taken an active part in receiving and reforming the younger classes of criminals long before the passing of the first Reformatory and Industrial Schools Act in 1854,† and had largely enlisted public sympathy and support in their efforts. The principle that Government aid should be combined with voluntary agency had also been recognized and acted on by the managers of these institutions, in the reception of a large number of boys sentenced to transportation or long terms of imprisonment, and pardoned

* In my 'Report,' I urged that the "combination of local with Imperial interests in the welfare of the school would be productive of good in regard to its management, and would ensure a proper use of the funds contributed for the purpose."—H. M. J.

† The Reformatory Schools Act, 17 & 18 Victoria, cap. 86. The Industrial Schools Act (Reformatory and Industrial Schools, Scotland, Act), 17 & 18 Victoria, cap. 74.

conditionally under the provisions of the Parkhurst Act (1 & 2 Vict. cap. 82).*

In 1848 Mr. Turner induced the Committee of the Philanthropic Society, using his own words,

"to take the step which was the commencement of the Reformatory movement on its present basis by removing their school from London and establishing their now well-known Farm School at Redhill, in Surrey, adopting and following out the ideas and plans on which the celebrated M. de Metz had founded so successfully the agricultural colony of Mettray, in France.† For carrying out this enterprise the first step was to visit and thoroughly examine the Mettray School, which I did in conjunction with the late Mr. Paynter, one of the Metropolitan Police Magistrates; the second was to interest the English public in the provisions of the French Penal Code, by which offenders under sixteen years of age are held to have acted '*sans discernement*,' i.e. without sufficient knowledge of right and wrong, and to require correctional training rather than penal treatment; the third was to work out the Mettray plans and principles upon an English footing."

Mr. Turner thus records the commencement of the establish-

---

* "The third distinguishing feature of the English system, which I regard as one of the keystones of its success, has been that, while assisted and superintended by the State, the schools are essentially conducted and controlled by voluntary management, and have throughout retained an independent and partially charitable character.

"This has secured two essential advantages; on the one hand, it has opened to the inmates of the schools means and opportunities of employment and openings for gaining an independent livelihood on their discharge from detention, which no juvenile house of correction under purely official management, whether Government or magisterial, could have given them, enlisting and interesting in their disposal private individuals of all classes, and allowing them to enter life without any brand or drawback from the character of the place they came from, substituting the school and benevolent asylum for what must always have had more or less of the character of a prison."—Rev. SYDNEY TURNER.

† The agricultural colony of Mettray was founded in 1839 by M. de Metz, an eminent Judge of the French Royal Court of Justice, who resigned his high position for the purpose of devoting his life to the reformation and education of young criminals. After having visited the principal establishments which in those days existed for the treatment of young criminals, in England, Belgium, Holland, Germany, and the United States, he determined to take as his model the Rauhen Haus Reformatory School at Horn, near Homburg, which had been founded by M. Wichern in 1833. At this establishment the inmates were divided into groups or "families" of a dozen children, each family having its own paternal head and its separate habitation. To enable M. de Metz to carry out this idea successfully, one of his first efforts was to enable a sufficient number of men to be properly trained as superintendents of houses; therefore, soon after the young criminals began to arrive at Mettray, he established a special school for the training of superintendents, or "chefs de famille," as they were called. This training-school is still an integral part of the Mettray Reformatory. It is only necessary to add that, in the course of 1839, four "chalets" for the reception of the "colons" were erected, and that by June 7th, 1840, as many as 82 children had been received. Now the establishment consists of ten chalets, the training school, director's residence, church, &c., and several farms and farm-houses in the neighbourhood,—the total number of inmates being about 800, of whom five-sixths are employed in agriculture. I visited this Reformatory a few years ago, and was much struck with the excellence of all the arrangements. A very noteworthy point is the system of training the persons who are to be placed in authority over the inmates. —H. M. J.

ment of Reformatory Schools for boys in several districts by voluntary and independent efforts:—

"In Gloucestershire, by Mr. Barwick Baker, at Hardwicke, and by Miss Carpenter, at Kingswood, near Bristol; in Norfolk, by the late Mr. John Wright, at Buxton, near Norwich; in Warwickshire, by Mr. Adderley, at Saltley, near Birmingham; in Worcestershire, by the late Joseph Sturge, at Stoke Farm, near Bromsgrove; and at Newcastle-on-Tyne, by Captain W. O'Brien. These schools were all studiously founded in something of a spirit of contrast to Red Hill, which some thought to be on too costly and artificial a basis for general imitation, and aimed at the utmost cheapness and simplicity as to accommodations, and the closest personal associations and equality of teachers and inmates.

"The Newcastle School was ere long removed to Netherton, near Morpeth, and is now, with its extensive buildings and large farm (above 400 acres), one of our largest and most effective institutions."* The other four have successfully survived their early struggles, but are considerably enlarged as to buildings and much modified as to arrangements and discipline.

"The Hardwicke School was of great value, as encouraging the magistrates and leading gentlemen of other counties to similar efforts in their own neighbourhood, and in most cases on their own estates. Mr. Barwick Baker's personal example as a magistrate and landowner had far more effect in this direction than the work of a London charitable association, such as the Philanthropic Society, could have had. And, although subsequent experience has shown that rough accommodations, inconvenient buildings, and amateur or very cheap superintendence are more expensive and less efficient in the end than buildings planned and furnished for the purpose, and a competent staff of officers, at least partially trained for instruction, and fairly remunerated for their labour, there is no doubt that the plain familiar style and tone of these earlier institutions did much service in essentially stimulating the spread of the Reformatory School system. Each school that was added to the list contributed a fresh quota of experience, and helped to show by the practical necessities of its own progress that there were certain conditions of subordination and discipline without which neither self-regulation could be taught nor mental and industrial training carried out, which are in fact essential distinctions between liberty and licence."

REFORMATORY SCHOOLS.

I.—Bedfordshire Reformatory.

"The average number of boys in the school is 54. Their average age on admission is 13, on discharge, 17. The ages preferred are over 12 on admission, and over 16 on discharge. The past history of the boys is chiefly the result of parental neglect in all its varied forms. As regards the career of those who pass through the course of Reformatory training, from 75 to 85 per cent. *do well*, and become respectable members of society, as proved by the Beds Reformatory records during the last 20 years. An average of 7 hours per day is devoted to ordinary work on a farm of 50 acres of land, cultivated entirely by spade labour, a portion (about one-tenth) of which is garden ground.

* This valuable farm school owed its establishment chiefly to the efforts of the late Mr. Burdon-Sanderson, whose death from the fatal railway accident near Huntingdon deprived the school and many other public agencies of a most able and conscientious adviser.

20 garden plots (of 2 poles each) are given as rewards to the best boys for good conduct, and as incentives to industry. There are 4½ acres of permanent grass, 40 acres of arable land, and 5½ acres of garden, which last is freehold, and therefore no rent is paid for it; the rent of the grass land is 4*l.* per acre, and that of the arable land 30*s.* per acre. Bonuses are paid to the inmates on the "*mark system*" * to the extent of about 50*l.* a-year. Payments are made to ordinary labourers of about 12*l.* a-year, and to the bailiff and labour-master of 50*l.* a-year. The four-course system is adopted; viz.: 10 acres beans, 10 acres wheat, 10 acres roots (mangolds and potatoes), followed by 10 acres barley. The live-stock consists of 1 horse, 8 cows, and from 50 to 100 head of pigs.

	£	*s.*	*d.*
"The value of stock sold off the farm in 1884 was	217	7	0
" " " slaughtered and utilised in school in 1884	47	13	6
" " farm produce sold in 1884	122	18	11
" " farm produce utilised in the school during 1884, everything charged at the current price of the day	91	6	0
Total	£479	5	5

"There are covered farm-yards, and every necessary convenience, thoroughly good.

"I consider farm labour an excellent means of cultivating the mind in a right direction. Moreover, a thoroughly well-trained, experienced man in agriculture and in the management of stock, if industrious and frugal, need never lack employment, and may be sure to rise in the social scale of life. A dairy is attached to this Reformatory, which affords instruction and employment, and is also a source of profit, but no special observations are taken, nor is special instruction in the work given to the boys. The out-door employment, in general farm and garden work, is more *healthful* and *invigorating* than trades, such as tailors, shoemakers, millers, bakers, &c., &c., as evidenced by the fact that not a single death has occurred amongst the inmates of the Beds Reformatory, and only two boys have been discharged on medical grounds as being found unfit for agricultural labour, during the last *twenty years.* Incidentally, a certain number of the boys receive special training in the ordinary work of the establishment, viz. (1) In cooking and preparing food in the kitchen; (2) In bread-baking, &c.; (3) In milking and dairy work; (4) In tailoring; chiefly in making and mending the clothes of the boys. Proficiency in these departments is found very useful in obtaining places for the boys, and in their advancement in life.

"I am decidedly of opinion that the elementary education which is given in Reformatory Schools in no way suffers from its combination with practical work, but is rather advanced by it. Boys in a Reformatory are continually under discipline, and are receiving an education, even though not actually under the schoolmaster, nor in school hours. Hence, although the time devoted to schooling (about 4 hours each day) is not so long as in Board Schools or Voluntary Schools, boys make more rapid advances, during the time they are under detention, than they would if they had been subject to ordinary school work. Also the religious teaching (including sacred music), which boys in our Reformatory receive on Sundays, is a valuable additional means of education. The upper class of boys (about 20, out of a total in the school of 54) is examined in Standard V. of the Education Code, and, with three exceptions, all passed satisfactorily at the last examination. Reformatory boys, as a rule, compare favourably in the matter of intellectual attainments with average labourers' children in rural districts, more regularity of teaching

* For an example of this system see pp. 208 and 209.

being secured. Regular and sufficient food, combined with regular exercise (in farm work)), appears to train the body so as to make the mind receptive of regular, but not too continuous, intellectual effort.

"W. Francis Higgins,
"Chairman of Committee of Management,
"*Bedfordshire Reformatory, Carlton, Bedford.*"

I visited this school on August 12th, 1885, and was much struck by the number of head of stock kept, and the goodness of the crops. The land is mostly stiff on a clay subsoil, but there is a strip of light land in one corner of the farm. How one horse and eight cows could be kept on a farm with only 4½ acres of high-rented but poor grass was rather puzzling to me, until I learnt that 1½ acres of the arable land was always in lucerne. With the exception of a portion of the potatoes, all the crops are consumed either in the house or on the farm, in addition to purchased cake. The bran, and an unseparated mixture of finer offal known locally as "dan," are returned by the miller, as Mr. Jones finds it more profitable to have his wheat ground, and to be charged for grinding on the basis of the miller fetching the wheat, returning the flour and the offal, and charging 6*d.* per bushel, with a deduction of 2 lbs. weight for loss. The farm-buildings are very good and include some new covered yards. The liquid manure is carefully stored, and used chiefly for lucerne and cabbages; it is also pumped over the compost and farmyard-manure, which is made into compact square heaps surrounded by a gutter. There is a great demand for the boys from this school by the farmers of the North and West Ridings of Yorkshire, in districts where lads are boarded and lodged in the farm-houses. Mr. Jones, the excellent manager, is of opinion that the first object of a Reformatory is to reform the boys, not to make the greatest profit out of their labour; nevertheless, considering that the school is in a purely agricultural district, I believe that he goes the right way to combine "profit" with "reform." The boys prize their gardens very much, as they are large enough to enable them to grow a bushel or two of potatoes, which they may sell. Mr. Jones gives prizes for the best-managed gardens, and when boys leave the school they may sell their gardens to the highest bidder amongst those inmates whose marks entitle them to the possession of one. The maximum number of marks for a month is 144, and this carries a payment of 1*s.* to the boy's banking account, on which the lad may draw in order to purchase things that are not forbidden by the rules. Of the total number of boys in August 1884, 16 were in the Fifth Standard, 14 in the Fourth, 11 in the Third, and the remainder (only recently admitted) were in the lower standards.

II.—Bradwall (Cheshire) Reformatory School.

"This school was established in 1855. It will hold 65 boys. The average number was 62 in 1884. I do not like to take boys under 11, nor except they have had two previous convictions. Boys stay up to 19 and 20, though discharged on an average at 15 to 16. They all are criminal,—the worse they are the better I like them. They come from manufacturing towns and sea-ports, and a few from the rural districts. They become soldiers, sailors, labourers, and artizans; and about 80 per cent. turn out well. I do not care about teaching trades (as they are costly in masters, and boys will not stick to them), except what comes in the actual farm work, such as care of stock, milking, ploughing, digging, &c. My idea is that with a criminal boy the one thing to teach is an industrious habit, and that the penalty for all the crimes of his previous life is a steady monotonous grind of wholesome work, food, and play, with as little Bohemianism as possible.

"Farm-labour is given as the simplest industry and as the most wholesome employment. Boys are paid according to a scale of marks, dependent upon 'Work,' 'School,' and 'Good conduct,' by which each lad not only receives a reward for his own conduct, but benefits or suffers by the conduct of the whole school. If, *e.g.*, the average of marks exceeds a certain standard, the scale of pay rises throughout the school, and so on. There are some few boys who are almost exclusively employed among the stock. These boys, as a rule, do not get any morning school, as they have gone early to the farm; and we are obliged, in consequence, to make their school short and easy. Any boy may have a garden plot, as a matter of course, by asking. The smartest lads take it for 'button-holes' worn on Sunday. Some grow mustard and cress, &c. After a day's field-work, I suspect the lads have had enough of the soil, and the novelty of the possession of a plot soon wears off. Our whole farm is 116 acres. One field of 23 acres has never been broken up. On an average, I should say we have 60 acres under spade-cultivation, and the rest in pasture—permanent, or down for more or less time. There may be an acre of garden land and playground round the school. The rent is 208*l.* 5*s.*, and there is an unimportant rate. As the land has been drained and improved, I suspect it would fetch 2*l.* 5*s.* to 2*l.* 10*s.* in the market even now. At one time a tenant-farmer valued it at 3*l.* 10*s.* per acre. I place the payments to boys as rewards from the general funds, and do not charge them to the farm, and so of the payments to 'labour-master,' who acts as usher and schoolmaster, and helps in the general discipline. My bailiff and his wife have 120*l.* per annum; house, coals, vegetables, &c. My calculation is that the cost of the bailiff and labour-master is about what would be paid for labour on a farm of that size, but that the boys find the labour, the men the superintendence. There are a few pounds paid each year for 'threshing machines' and the accompanying labourers with it, &c. Heavy clay management, under spade-labour, can, in my experience of 29 years,' never be quite controlled by a fixed rotation. A wet season throws all calculations out. We try for a five-course, oats, wheat, green-crop and beans, oats or barley, clover; manuring heavily the green crop, and liming when clover is broken up. Occasionally we put a field down for a series of years, and dig up another if the quality of grass is failing. We never think it pays to grow potatoes on heavy land. They can be purchased cheaper. The second crop of clover is dressed, and we always have a heavy growth. With 60 lads we can save hay in any weather, and even in the wet years we are never in want of late hay, and have not thought of ensilage. The great secret of good farming on our land and under our conditions is to keep off it until it is dry, and never to dig wet soil.

"Our stock in trade on Dec. 31st, 1884 was, and their value:—

Cattle (45): Milch cows, 22; feeders, 6; 2-year-olds, 6; yearlings, 11. 562*l.*

Horses (5). 156*l.*

Pigs (18). 63*l.* 15*s.*

Grain (wheat, oats, beans, &c.), 102 quarters, 168*l.*

Straw, 17 tons, 33*l.* Hay, 49 tons, 163*l.* Turnips, 39 tons, 35*l.* Cheese, 84*l.*

"Vegetables are grown in the 'school' garden, and do not come into the bailiff's accounts. A large number of poultry on the farm, the perquisites of bailiff's wife, &c., also do not come in.

"Extract from Farm Accounts.

	£	*s.*	*d.*
"Sales—			
Wheat, barley, beans, &c.	103	12	0
Milk, butter and cheese	125	19	8½
Live stock	355	6	10
Supplied to School—			
Meat (pigs)	21	18	1
Milk and butter	110	8	8½
Total	£717	5	4

"I took another lot of buildings, of which I had annexed the land from the school-farm, and put my bailiff in the house, and altered the old buildings. They are now tolerably good. We have cow-tying for some 20 cows and for 14 young stock; a yard which I mean to roof in, stabling, and a large shed for cows. They are far from perfect, but are better than the average. Probably their being somewhat inconvenient is a better training for the boys, who, if they go to farm labour, will not as a rule, in Cheshire, find perfect buildings.

"I believe in farm-labour for a town-boy, as most wholesome to body and mind. It is stupid, unexciting, monotonous, and no romance can be got out of it; and it gets a lad to see that if he waits and is patient there is a profitable result. A Cheshire constable told me that boys from farm schools always act better when they get home than boys from trade schools. The few boys who are employed with the stock, as milkers, cow-boys, horse-boys, &c., can have their pick of places, as they are known to be well taught; but, 1st, only a certain number are fit for this; and, 2nd, a child of an artisan who makes 2*l.* to 3*l.* per week does not care for farm-labourer's wages. I confess I do not think much advantage comes from the teaching.

"A school dairy works under disadvantages. We must have milk for the boys all the year round, so the cheese is never large. We make our own cheese for consumption, and sell some; so of butter. We have never attempted a model dairy. I used to let boys out, but have discontinued the practice. It did the boys no good; and, as Cheshire farmers do not hoe wheat, there was small demand. I occasionally take a field of corn, and send my machine and the boys into it, but this is rather to help a neighbour than as a habit for profit. I incline to think that our special feature is tidiness. With 60 lads it would be discreditable if it were not so. A weed is quite an exotic. Of one point I am practically satisfied: our cultivation by spade is 13 inches deep; as compared with plough-work we require at least half more manure, and all our crops ripen 10 to 14 days later. I should like to be allowed to express my opinion that the (*b*) part of question 7 is less satisfactorily answered in a Criminal School like Bradwall, largely recruited from an urban population, than it would be anywhere else. I have always found that whatever agricultural

situations you find for a town-boy, he will ultimately, with certain exceptions of character and temperament, drift back to the town. My idea, therefore, has been that the one thing to be aimed at is to inculcate habits of steady industry, and to get rid, if possible, of the boys at such ages as they may be able to take up a trade. But I can well conceive the great advantages to a country lad who has no hankering after the flesh-pots of a town, and to whom the idea of 18*s*. per week is riches, being benefited by technical instruction in the use of engines and tools; also, perhaps, more by being under a good bailiff for 6 hours a-day, seeing how to handle and feed stock, &c.

"I should say there was no dread that elementary education would suffer in the least from its combination with practical work, if human nature were non-existent. But the testimony of all bailiffs is, if they get a half-time pig- or cow-boy, to keep him when he is useful to them, and it cannot be controlled. But I am sure that the work done intellectually by Bradwall boys is on an average equal to the work done by those in other schools in quantity and quality. Boy for boy, a lad who works in the open air from 10 A.M. to 12.30 P.M., and from 2 P.M. to 4 P.M. will know more at the end of the day than one who has been at school.

"GEORGE W. LATHAM,
"Manager of the Bradwall Reformatory School,
"*Sandbach, Cheshire.*"

It is unnecessary for me to add anything to Mr. Latham's very full and interesting description of this school, which I visited on June 5th. I can, however, testify to the cleanliness of the land and the promising appearance of the crops. H.M. Inspector has certified to the satisfactory nature of the educational condition of the boys, 14 having been in the Sixth Standard, 6 in the Fifth, 12 in the Fourth, 15 in the Third, &c. "All getting on and doing well."

III.—DEVON AND EXETER REFORMATORY FARM SCHOOL.

"There are 30 boys, whose ages on admission are from 11 to 15 or 16; on discharge, 15 to 18. Boys are admitted who have been at least *twice* convicted of crime, or are known to have been companions of thieves. About 85 per cent. of the boys discharged have turned out well, and many more have done well after having been re-convicted once.

"All the inmates are employed in gardening and farming. A little tailoring and carpentering are also taught. Boys also work for the neighbouring farmers, the manager's aim being to develop the boys' physical powers, and to fit them for *continuous* and hard work. Boys are classed according to conduct, and receive: 1st class, 6*d*.; 2nd class, 3*d*.; and 3rd class, nothing per week. Extra money is given at harvest time for working for farmers. Being always at garden work, boys do not care for plots well enough to work in them over hours, and therefore plots are not now given.

"There are 2½ acres of grass, 14 acres of arable land, 1½ acres of trifolium, &c., and 7 acres of garden. The rent of the land is 35*l*. 10*s*. per annum. The payments to boys, 9*l*. to 12*l*. 10*s*.; to a labourer, 40*l*.; and to a bailiff, 23*l*. The superintendent has the supervision of all the work. One horse is kept, and about 30 pigs; also fowls.

"The receipts last year were as follows:—

	£	s.	d.	£	s.	d.
"Sold—						
Live-stock	27	1	3			
Vegetables	65	9	9			
Wheat	22	1	3			
Seeds	2	3	1			
				116	15	4
Supplied—						
Live-stock	29	12	6			
Vegetables	27	2	7			
Firewood	7	10	0			
				64	5	1
Horse-feed				17	10	0
Boys' labour for farmers				105	10	7
Total				£304	1	0

"The farm-buildings consist of barn, piggery, stable, cart-sheds, and root-house—all small, but suitable for a small farm, and the dry-earth system gives some manure.

"One, if not the chief, necessity in the training of street boys is to make *continuous* work easy to them, and farm work certainly is the best work known for making any boy healthy and strong to labour. Hard continuous work to a feeble lad is simply severe punishment, but to a healthy strong one a pleasure. These boys make capital soldiers, sailors, emigrants, or anything else. The only outside work is done for neighbouring farmers in the harvest fields, farmyards, and houses. We find this kind of work of much service as a reward to the boys, trying their honesty, industry, &c., and also training them in many useful works upon the farm. The school-work is done after the day's work on the farm is over, and the boys are trained to the service of God, and, especially, good morals are inculcated.

"We find that 'elementary education' has to be confined to few subjects in each Standard in our school. Reading, Writing, Arithmetic, Dictation, and the composition of a letter, will all, I think, compare favourably with Board Schools; but our boys are much older than Board School children.

"My personal opinion on labourers' children being trained in technical work is decidedly against such training at so early an age as those children leave school. I think that such very young ones should give all their time to mental work, *i.e.*, to what we now consider and call 'elementary education.'

"If we could induce parents to keep their children in school another year or two, technical education may well take the place of, say, English literature, and be most beneficial to the children. Apropos to this, I have found, curiously enough, that in a mixed school, where the girls spent about five hours a week in sewing, &c., they were able to keep, and did keep, abreast of the boys in *elementary work!*

"William Harris,
"Superintendent, Devon and Exeter Reformatory Farm Schools,
"*Brampford Wood, Exeter.*"

This is an interesting school, situated on high ground, the land being well cropped with market-garden vegetables, such as broccoli, cabbages, savoys, onions, parsnips, turnips, &c., as well as small areas of wheat, barley, and oats. At the time of my visit (August 27th) the scarlet runners were still very fine, as they had been persistently watered throughout the long drought. These were selling very dear on Exeter Market, to

which the best of the products of the land are sent regularly. The remaining vegetables are either supplied to the school or consumed by pigs, which are largely kept. There were 4 breeding sows, and about 16 of their produce are fattened annually, the rest being sold young to neighbouring farmers or to cottagers. The Superintendent has thirty years' experience of the school, and, like some other managers, he finds that the boys sent are smaller than they were some years ago; most of them abandon agriculture for other pursuits when they leave the school, becoming frequently either soldiers or sailors, while a few emigrate. Of the 31 boys examined in 1884, 2 were in the Fifth Standard, 8 in the Fourth, 10 in the Third, and 11 in the Second.

IV.—Glamorganshire Reformatory School, Ty Segur, near Neath.

"There is accommodation for 65 boys, and the average number maintained in 1884 was 50; recently it was over 60. The ages on entering are from 9 to 14, and on leaving, from 15 to 19. The sentences vary from 3 to 5 years. Many of the boys have been convicted twice and upwards; they are mostly the neglected children of drunken parents in the large towns in the county.

"For six months in the year the boys work six hours a day on the farm, and for the other six months, six-and-a-half hours (some are detailed for housework and the tailor's shop). No plough is used, but all spade labour. Each boy receives 1*d.* per week for school-work, and 1*d.* per week for labour. Monitors and very industrious boys receive more. Plots of garden ground have not been allotted to the boys here, but in lieu of that they are allowed to have lettuce, rhubarb, cabbage, &c., from the garden occasionally.

"There are 19 acres of grass-land, and 22 acres of arable; about 5 acres sown with barley, oats, and vetches; the remainder with swedes, mangolds, turnips, and general garden produce, suitable for market. The rent of the farm is 54*l.* per annum. In 1884, the rewards to boys for farm labour amounted to 13*l.* 11*s.* 6*d.*; payment to labourers, 2*l.* 19*s.* 9*d.*; and to the farm bailiff, 78*l.* The land is changed for the different crops every year, but there is no regular rotation of cropping. One horse, 4 cows, 2 or 3 breeding sows, boar, 8 store pigs, and about 2 dozen poultry are kept.

"In 1884 the following amounts were realised:—

	£	s.	d.	£	s.	d.
Live-stock sold				82	13	6
Produce				252	6	5
Supplied to school—						
Meat	10	6	8			
Vegetables	21	6	0			
Butter and milk	34	4	7			
				65	17	3
				£400	17	2

"The farm-buildings are new and very compact; viz., cow-shed, stable, commodious loft over shed, 5 piggeries, cart-shed, storing shed for roots, and barn with potato storage in it. Farm-labour exercises a healthy influence on the boys' minds; they quickly learn to take an interest in it, and in all apper-

taining to the farm. It gives them a good idea of farming, and accustoms them to habits of steady industry. But as this is not an agricultural district, few of them are able to follow it up; but on leaving they mostly get remunerative employment in the numerous works in the district, and many go to sea; in all of these they find the benefit of their previous training, being very hardy.

"We do not think that the elementary education suffers through being combined with practical work, but the number of hours devoted to school work in Reformatories does not allow of so many subjects being taught as in Board Schools. The hours, however, in which school work is carried on in Reformatories would not be practicable in Voluntary Schools, being early mornings and evenings.

"D. J. Rhys,
"Secretary, Glamorganshire Reformatory School,
"*Ty Segur, near Neath.*"

This is a well-built school, situated on the top of a "mountain" innocent of a road. The soil is very thin, and in many places the bare rock crops up; some of the land is very wet, and has been stone drained. As the rock is generally only a few inches beneath the surface, the grass easily becomes burnt up; but, on the other hand, owing to the configuration of the rock-surface, one corner is wet enough to allow of the growth of osiers, which the boys use for basket-making. The land was throughout very clean, and the crops of cabbages, savoys, broccoli, &c., were on August 26th very good for the year. Onions and parsnips are also grown, and salt is found useful as a preventive of disease in these vegetables. The produce is chiefly sold at Port Talbot, because the tradespeople of Neath rebelled against the competition of the school. Of 51 boys, the Inspector found 20 in Standard Five, 8 in Standard Four, and 10 in Standard Three.

V.—The Hardwicke Reformatory (Gloucestershire).

"Eighty-four boys were the average of last year (1884). They must be, in the opinion of the Court which commits them, under 16 when committed. We don't like receiving them under 12. They are committed to us for from 3 to 5 years; we may allow them to go to work after 18 months, but we keep a watch on them, and recall them if they are not satisfactory. We keep our boys here on an average 2½ years. We make a return of all boys whose sentence has expired within 3 years. Last year there were 90 such; 85 reported doing well; 3 doubtful (*i.e.* idle, or out of work, or suspected); 2 convicted; none unknown. Their past history would be far too long to write; their future we cannot tell. But we have to keep a watch on them for 3 years after the expiration of their sentences (this is often for 5 years after they leave us on licence). The report of 1883 was that 56 boys had left us during 1881–82–83, of whom 2 were re-convicted, 2 were idle or unsatisfactory, and the rest were doing well. We consider that one of the most important parts of education we can give our boys is to teach them to earn their own living. Most of our boys come from the large towns, and most of them return to a town life, but for all the first essential is—a *habit of steady labour*. I know of nothing which gives this habit so well as steady agricul-

tural labour with the spade. We teach the boys to earn part of their keep in the schools as a preparation for earning their whole keep in future. As to physical training, not having had a doctor for 2 years will say good each way. Remuneration: boys are not like men, for they value their earnings only to spend all they get, as a rule. We do not give any pay; we expect and teach them to work from principle, a big fellow to do more than a small boy. And for 10 years now have found it to work well. We could never gauge the amount of work to each boy, so many are the differences in physical power; not one out of ten cared for a piece of garden land; they would rather play than attend to their garden; we gave it a trial for 14 years. We do a great deal of work for neighbouring farmers, taking a field to be hoed, or sheaves bound, at the average price of the country, and sending a man with 20 or 40 boys to do the work. The profits of the farm and the boys' earnings all go to the support of the school. The farm consists of about 52 acres of pasture, and 35½ of spade-dug arable land. The payments or bonuses to inmates are nil; to ordinary labourers, 171*l.*; and to bailiffs or other superintendents, 57*l.*, including house, garden, fire, and light. All except the grass is worked by the spade. We get a large quantity of manure from Gloucester (5 miles off), and grow a great proportion of wheat, also beans and roots. Three horses are kept, but they are not much used on the farm. The other live-stock consists of milch and other cows, 17; calves, 10; sheep, 20; pigs, 24; poultry, 21.

"The amounts received and earned for farm produce in 1884, were—

	£	s.	d.	£	s.	d.
Wheat sold	177	1	0			
Butter	22	10	2			
Live-stock	516	15	11			
				716	7	1
Supplied to School:—						
Wheat (flour)				40	0	0
Meat				86	0	0
Vegetables				39	2	6
Milk				64	15	2
Total				£946	4	9

"When the mind has a decided warp towards crime, the first requisite is to get rid of evil thoughts. In shoemaking or tailoring the thoughts will often stray even by day, and at night they have full play; but during and after a hard day's digging there is no time for bad thoughts. A London boy thief of the old days, four times or more convicted, skilled and hardened in crime, would often in a week's time become tractable, and have forgotten for the time all his evil ways. Farm work is good as a base. We try to have some repairs, alterations, brick-work, carpentering, painting, gardening, trap and horse to clean, &c. If boys are not made generally handy, they do not keep their places.

"We must explain that until about 1877 this Reformatory, receiving few except Gloucestershire boys, seldom averaged above 40 inmates. In that year an extraordinary wave of crime seemed to pass over England. Most of the reformatories were nearly full, and would receive no more. We hold that we ought to receive boys at any inconvenience, rather than send twice or three times convicted boys back to their streets. We therefore slung more hammocks in workrooms, and built some additional rooms, and received about 80. The large towns still continue to send them, and the number remains about the same. About a year ago 50 acres of land were added, and we therefore have had little experience of the result.

"We cannot compute with any accuracy the different effects of mental in-

struction given at a school where a habit of bodily labour is considered to be of great importance with one where this habit is neglected, because the ages of the boys—in the one case from five to twelve, in the other from twelve to eighteen—and their capability of receiving and retaining instruction are so different; but we should say at a guess that if the ages were similar, the boys at an Industrial School would receive instruction for one-third of the time, and would learn and retain two-thirds as much as those at a Board School.

"Let us add that other countries are feeling the necessity of Industrial Education. At a meeting at Detroit, last October, of the Prison Association of America—where most of the States were represented—Rutherford B. Hayes, a former President of the United States, urged strongly that 'among the capital leading causes of crime we must surely include the inability and unwillingness of our young people of both sexes to make their living by manual labour,' and it was resolved by the Congress—that 'We earnestly recommend the education of the youth of both sexes in industrial pursuits, employing and training the faculties of the mind and body in productive labour, as an important means of preventing crime.'

"They say that many dislike bodily work, and fall into the ranks of *clerical indigence.*

"T. B. LL. BAKER, and G. E. LL. BAKER,
"Managers,
"*Hardwicke Reformatory, Gloucestershire.*"

In this instance, again, I have little to add to Mr. Baker's own statement, except that, as the Reformatory is one of the oldest in the kingdom, it is naturally not so well provided with modern appliances as those since erected at much greater expense. The soil is heavy, and the crops which I saw on August 20th were exceedingly good for the land. The educational status of the boys is "rather behind-hand;" for out of 84 boys, only 4 were, in 1884, in Standard Five, 13 in Standard Four, 25 in Standard Three, and 18 in Standard Two.

VI.—KINGSWOOD REFORMATORY SCHOOL (GLOUCESTERSHIRE).

"The average number of boys at this school is 148; their ages on entering are from 11 to 16; and on leaving, from 16 to 20. The bulk of the boys come from town, and return to town life when they leave the school. About 25 boys are employed on the land (which consists of about 15 acres of garden), receiving nominal sums for their labour, according to their work. There are 14 plots of garden ground, but they are not all taken up by the boys. There are no ordinary labourers, but 25*s.* per week is paid to the gardener. The live-stock consists of 1 horse and 2 sows; no cattle, sheep, or poultry are kept. The horse is used for the general purposes of the institution as well as for the land.

	£	s.	d.
"In 1884 sold live-stock	20	12	0
" produce	58	12	6
Used in school, live-stock	8	2	8
" produce	67	7	0
Total	£154	14	2

"Farming is undoubtedly one of the best occupations for the improvement of the boys, but we have no means at our disposal here to enable it to be a means of future advancement in life.

"I cannot readily answer the last question. My own idea is that the two things can be well combined, and might help each other. But it can easily be answered by comparing the ages at which boys at a Reformatory pass a particular standard as compared with boys at a Board School, making allowance, of course, for their ignorance (or otherwise) when they first come to the Reformatory.

"HENRY N. ELLACOMBE,
"Hon. Secretary,
"*Bitton Vicarage, Bristol.*"

The garden attached to this school is the site of an old brick-field, and one of the most unpromising places imaginable. It has been made at great labour by carting soil upon the bare subsoil. The 25 boys employed to work in it are generally the smallest and weakest, the object being to give them strength and stamina. Until the present year, a considerable proportion of the land was in corn-crops, but the new gardener has it all in vegetables, chiefly potatoes, and the several varieties of the cabbage-tribe, and a few fruit-bushes. As he says that there is a good market in Bristol for everything he can grow, it is evident that with a superabundance of labour the receipts should be greatly increased under this system. In 1884, H.M. Inspector found 16 boys in Standard Five, 29 in Standard Four, 28 in Standard Three, and 36 each in Standards Two and One.

VII.—HERTS REFORMATORY SCHOOL, NEAR WARE.

"The school is certified to receive 50 boys, and the average number is about 45. None are taken under 12 years of age, or for a period of less than 3 years; sentences of 5 years are preferred. The Committee prefer boys who have been convicted more than once. The Committee take every opportunity to procure their employment on licence before their term of detention expires, and do all in their power to provide them with suitable employment, by emigration or otherwise, at their final discharge. Agricultural operations are used as a means of employment. Small pecuniary rewards are given to boys for industry and good conduct, but they are not paid for their labour. They have small plots of garden ground, which they cultivate as a recreation.

"The farm consists of about 8 acres of grass-land, about 30 acres of arable, and about 1 acre of garden. The rent is 53*l.* 4*s.* for the whole, and the payments for labour 18*l.* 16*s.* 6*d.* to boys as above; 28*l.* 13*s.* 11*d.* to outside labourers and for team hire; and 62*l.* 8*s.* to bailiff. The four-course shift is adopted in the cultivation of the land, and the live-stock consists of 1 horse, 4 cows, 2 sows, and various pigs, as well as fowls.

"The receipts from the farm in 1884 were:—

	£ s. d.	£ s. d.
Wheat, barley, &c.	70 12 6	
Milk, butter, &c.	16 15 7	
Vegetables (potatoes, &c.)	47 11 0	
Hay, seeds, &c.	17 6 0	
Live-stock	58 17 0	
Swedes, fed by sheep	5 12 0	
		216 14 1
For supplies to School:—		
Meat	18 3 8	
Vegetables	35 15 10	
Milk, butter	47 0 6	
		101 0 0
Total		£317 14 1

"The farm-buildings consist of barn, cowhouse, sheds, and pigsties, built of wood and slated, and a small farmyard. The Committee regard farm-labour very suitable as a means of training boys in habits of honest industry. They are taught the right way of handling and using tools, so as to fit them to become good agricultural labourers. The boys are eagerly sought after and employed by the neighbouring farmers, who are always glad to obtain their services. Last year they earned for the school more than 300*l.* in this way.

"I do not think that Elementary Education (meaning, instruction in the three R.'s, which is nearly all we aim at) suffers at all in our school by its combination with practical work, and I shall be very sorry to see any attempt to cram our boys with more book-learning at the cost of injuring our industrial learning, which, after the religious instruction, I consider to be the back-bone of Reformatory treatment. I have no acquaintance with Board Schools, therefore I cannot say anything about our work in comparison with theirs. I have often thought that it would be a good thing if some industrial training could be combined with the elementary education given in our rural schools, and especially in our Union Schools.

"JOHN B. BRANDRAM,
"Hon. Secretary,
"*Herts Reformatory School, near Ware.*"

The land attached to this school is gravel to the surface, very hungry and easily burnt, especially in a dry season like that of 1885. It cannot, therefore, be wondered at that the garden-crops, the turnips (although sown twice), and the clover aftermath, were all miserable exhibitions on August 11th. The wheat and barley, however, were promising. The best use made of the boys' labour here is to let them out, either on licence or in gangs, to the neighbouring farmers, who pay 2*d.* an hour for each boy's work, and find the labour cheaper and better than that they obtain in the ordinary way. The greatest punishment to a boy for bad behaviour is not to allow him to go out to work. When the boys have served their time, the great difficulty in the way of placing them out in England is the general one of lodgings; but many go to Canada. The level of education is not very high: 1 in Standard Five, 8 in Standard Four, 12 in Standard Three, 15 in Standard Two, and 7 in

Standard One. Still, what the boys learn, they appear to learn thoroughly.

VIII.—Liverpool Reformatory Farm School.

"The average number of boys is 135; their average age on entering is 13 years, and on leaving, 17 years old. The majority have been previously convicted for theft—some several times. According to the last report, 79 per cent. of those discharged were doing well. Farm and garden operations are the sole occupations of about one-third of the boys. Marks are given for their work, and remuneration accordingly. Garden plots were once given to the boys, but the result was not satisfactory.

"The land consists of 5 acres of permanent grass and meadow, 15 acres of arable land, and 8 acres of garden land; the rent of all the land being at the rate of 3*l.* per acre. The payments for labour to the inmates are about 10*s.* per week, the labourers' wages are 74*l.* per annum, and the bailiff gets 70*l.* per annum. The rotation of cropping consists in the arable and garden land being interchanged constantly. The live-stock consists of 1 horse, 5 cows, and 12 pigs. Cows and calves sold off the farm last year (1884) realised 42*l.* 19*s.* 4*d.*, and pigs were supplied to the school to the value of 63*l.* 11*s.* 5*d.* The farm-buildings consist of barn, stable, shippon, piggeries, sheds for stack and carts, and a corn-mill (water).

"Farm-labour being a healthy out-door occupation, it is not without a corresponding influence on the mind. As nearly all our boys are sent from Liverpool, they make their way back when free of the school. Some are licenced to live with the farmers; but when their time has run out their friends entice them back to Liverpool. Many are engaged by the day to farmers in the neighbourhood at certain seasons. One great advantage (and a most important one) which farm and garden work has over other employments—such as joinery—the material worked upon is not lost in the working. It is economical employment for juveniles.

"The receipts from the farm in 1884 and 1885 were:—

	1884.			1885.		
	£	*s.*	*d.*	£	*s.*	*d.*
Vegetables (potatoes, &c.)	107	18	8	137	10	9
Live-stock and wheat	81	9	4	59	3	0
For supplies to School:—						
Vegetables, &c.	56	4	0	62	11	0
Milk, butter, &c.	112	10	11	99	8	10
Meat and horse-hire and boys	128	16	9	176	13	1
Total	£486	19	8	£535	6	8

"You are aware that Reformatories and Elementary Schools are under different Departments; the management differs, and the object aimed at is, I take it, hardly the same; Reformatories partake of a penal character. Here, when Board scholars are in bed the Reformatory boys are in school. When Board scholars are in school the Reformatory boys are at work. The time given to Elementary Education in Reformatories is about three-fifths of that in the Board Schools. Can they fairly be compared with each other?

"My impression is (an opinion held by the Rev. Sydney Turner, the first Inspector of Reformatories) that the children of labourers in the rural districts would greatly gain if industrial work, such as farm and garden and rural carpentry work, could be combined with elementary education. Such an education and training would fit lads for the Colonies and for home work better than elementary education alone. In illustration of this opinion, I

enclose a letter * from a lad now with a farmer at St. Francis Xavier, Winnipeg, who left Liverpool in July last. At the school he earned his fare, from Quebec to Winnipeg, and 2*l.* pocket money he had with him. When admitted, he was in the 4th Standard; before he left he had gone through Barnard Smith's arithmetic and had acquired some knowledge of algebra. But his employer will value more than his acquaintance with algebra his ability to use the spade, the hoe, the saw, chisel, plane, and trowel.

"RICHARD H. ATTY,
"Superintendent,
"*Liverpool Farm School, Newton-le-Willows.*"

The Superintendent of this school is one of the Nestors of Reformatories, and it would be interesting to learn more of his experience and views with regard to their management and results. The school is easily accessible, being within ten minutes' walk of Newton Bridge Station, close to which is one of the monster paper-making and printing establishments belonging to Messrs. McCorquodale. Many of the Reformatory boys work there, and others are employed in shoemaking and carpentering at the school. Of the boys whose sole occupations are farming and gardening—for the greater part of the year on the land attached to the school—several are employed by the farmers in the vicinity at hay-time and harvest; and although they pay to the school authorities 1*s.* per day for each boy's services, it has been difficult to prevent them giving money presents to the boys, who consequently get into trouble, as they too frequently purchase prohibited luxuries, especially tobacco. In the garden, great attention is given to the production of the most highly priced commodities according to the demand for them, especially herbs and simple medicinal plants such as camomiles; but rhubarb, and other paying market-garden produce of large growth, are not neglected. A noteworthy feature in the management of the land is that, after the arable land has been used for the production of farm-crops for six or seven years, it is converted into a garden, and the old garden is restored to the farm. The educational condition of the boys is "well advanced;" at the 1884 examination 11 were in the Sixth Standard, 22 in Fifth Standard, 26 in Fourth Standard, 28 in Third Standard, and 34 in Second Standard; while 4 in the First Standard (no doubt recent arrivals) were "very ignorant." I may add that Mr. Atty showed me a very creditable little book on Canada, which had been written by an old inmate of the school, and had been remarkably well "got up" by the printer and publisher.

* This very interesting letter I returned to Mr. Atty. It is one of a large number of such compositions that have been shown to me at different Reformatory and Industrial Schools.—H. M. J.

X.—THE NORTH LANCASHIRE REFORMATORY, BLEASDALE, NEAR GARSTANG.

"On the average, 127 boys are maintained at the school, their ages being confined to the limits enacted by Act of Parliament. The farm comprises 153 acres. The boys are employed about eight hours daily at general farm work, under the charge of two labour masters, as well as road-mending (about 3 miles), draining, fencing, turf-cutting, &c. A cowman and six boys attend to the stock, and three boys are employed with the horses as well. All boys, whether engaged at farm work or at other kinds of work (tailoring, shoemaking, &c.), are paid for work done, and the amounts are entered to each boy's account, and they are fined for bad conduct. Separate plots of garden ground would not be considered a *reward* by our boys, as the time allowed for recreation at Reformatories generally is only sufficient for regular games. At present there are 131 acres of permanent grass, 20 acres of arable land, and 2 acres of garden, but these quantities include 66 acres just added (Feb. 2nd, 1885). On the arable land the rotation of cropping comprises potatoes, oats, and seed-grass. The rest of the farm is used as permanent meadows and pastures. The live-stock consists of 3 horses, 16 cows, 6 two-year-olds, 18 under two years, 1 sow, store pigs, and about 50 poultry. The general arrangements of the farm-buildings in the main are suitable and sufficient, and include covered manure-sheds and a silo.

"The chief value of farm-work for our class of lads is that, being a healthy occupation, it develops the physique of the stunted town-bred lads, and gives them a liking for work rather than for the idleness which too often has led them into criminal ways. The variety of work on a farm like ours develops the power of observation and does not prevent boys from getting on in other walks of life. But we generally find the less intelligent class of boys take to farm-work, and we encourage the more intelligent to follow the trades taught here. There is no difficulty in finding suitable situations for boys at farmhouses, when a boy is considered fit to be sent out on licence. For some years we have been engaged at reclaiming bog land, trenching, marling, &c., and this work seems well suited for this class of juveniles.

"The sales in 1884 were :—

	£	s.	d.
Oats	17	14	2
Milk, butter, &c.	31	12	6
Vegetables	4	13	8
Live-stock	131	4	11
Sundries	1	10	0
Supplied to school	207	19	10
Total	£394	15	1

"I do not think that elementary education suffers at all in such schools as ours by its combination with practical work, but that the lads make as much progress with the ordinary subjects whilst at school work as do the lads in elementary day-schools. Our lads generally move up a standard in school every year, and in many cases two standards. In comparing the results with ordinary Board Schools, it should be remembered that the majority of our lads are over the age at which boys are found at such schools, and they are treated more as striving lads who have left day-schools and receive their schooling in the evenings.

"ALFRED KING,
"Governor,
"*Bleasdale, near Garstang.*"

This Reformatory is situated in a rough country, and some of the quasi-agricultural work to which the boys are put is rather exceptional. Such include road-repairing, bog-reclaiming, and assisting in beating during the shooting season. For this latter work the school authorities receive 1*s.* 6*d.* per day for each boy's beating, while in hay-time and harvest they only receive from the farmers the usual pay of 1*s.* per day per boy. There being so large a proportion of the land in grass, it must be sometimes difficult to find physical employment for the boys in purely agricultural work, and this no doubt accounts for these employments, and also for harnessing boys to implements of cultivation, such as a ridging-plough, on the day of my visit. On the other hand, a certain number of boys (probably the best of them) help to tend the horses and cattle and assist in the dairy. Most of the boys who come from towns are taught trades, to enable them to earn their living when they leave the school; and about fifty are usually taught tailoring, shoemaking, &c. Seven boys passed the last examination in Standard Five, 24 in Standard Four, 33 in Standard Three, 32 in Standard Two, &c.

X.—Manchester and Salford Reformatory School.*

"The average number of boys maintained is 74. The ages of the inmates on admission range from 11 to 16, then after 3 years' detention they will range from 14 to 19. Our agricultural operations have never been profitable or instructive, because the land has so deteriorated in this locality, the result of which is that we intend giving up farming. We have about 76 acres of land, 57 of which are rented at 120*l.* Nearly the whole of the land is grass, and the live-stock consists of 3 horses, 13 head of cattle, and 100 head of poultry. My impression is that the cultivation of land is admirably adapted for such material as we have to deal with, but we are defeated in all our efforts by the pernicious influence of our atmosphere We are in close proximity to two chemical works, and the land is situated on the smoky side of Manchester, being only 3 miles from its centre.

"The sales and other receipts from the farm in 1884 were:—

	£	*s.*	*d.*
Milk, butter, &c.	105	7	5
Vegetables (potatoes, &c.)	53	5	10
Hay, seeds, &c.	78	16	6
Live-stock	41	4	0
Carried forward	£278	13	9

* In answer to my last question, the Superintendent (Mr. Henry Arnold) says, "If I understand it rightly, I do not think a teacher can as effectually teach a series of elementary subjects in 2½ hours per day as well as he can in 5 hours per day. Neither do I believe a scholar will be as well taught during the 2½ hours' schooling as he would be if he had double the quantity of time to devote to his subjects."

			£	s.	d.
Sales and other receipts, brought forward			278	13	9
For supplies to school:—	£ s. d.				
Vegetables	5 5 0				
Milk and butter	31 19 3				
			37	4	3
Hire of horses			185	2	4
Total			£501	0	4

"Herbert Philips,
"Hon. Sec.,
"*Manchester and Salford Reformatory School, Blackley, Manchester.*"

This establishment chiefly illustrates a point which was apparently very much neglected when many of the existing Reformatories were built, viz., the suitability of the locality and its surroundings. In this case the land is about to be given up on account of the pernicious effect of the vapour from chemical works and the unconsumed smoke of Manchester. Still, H.M. Inspector has testified that the school is "cleverly managed" by Mr. and Mrs. Henry Arnold, and the educational examination showed that, of 75 boys, 11 were in the Fifth Standard, 21 in the Fourth, 19 in the Third, 15 in the Second, and 6 in the First.

XI.—Northamptonshire Society's Reformatory for Boys.

"There are 45 boys maintained on the average. They are admitted between the ages of 10 and 16 years, and are usually sent for a term of 4 years; if, however, the boy's conduct justifies the managers in releasing him, and a suitable situation is procured, he is sent out on licence after having been in the school for a period of not less than 18 months. *Past history of the boys:*—bad, chiefly owing to parental neglect. *Future career.*—About 75 per cent. of those who have left the school are *known* to be earning an honest livelihood. Boys work in the field about seven hours daily. The gratuities for the past year amounted to 28*l.* The amount a boy earns is entered in a book to his credit; part of his earnings may be spent in the purchase of any little necessity while in the school, and the remainder reserved till after his discharge. Plots of garden ground are given, and found to be an attractive form of recreation, and also a means of instruction in horticulture. The farm includes 9 acres of permanent grass, 34 acres of arable, worked with spade-husbandry, and 2 acres of garden. The rent for the 45 acres is 129*l.* 12*s.* 6*d.* Payments for labour include bonus to inmates, 28*l.*, and wages of bailiff, &c., 62*l.* The four-course system of cropping is pursued, chiefly beans, wheat, roots, barley. The live-stock consists of 1 horse, 6 cattle, 20 sheep, 10 pigs, 20 poultry. The receipts for 1884 included—

	1883.		1884.
	£ s. d.		£ s. d.
Live-stock sold	111 5 3	....	84 5 2
Hire of boys and produce	{192 15 0 / 86 5 10}	....	329 11 9
Supplied to school	27 10 0	....	26 5 0
Total.. ..	£417 16 1*		£440 1 11

"The farm-buildings are suitable; built partly of stone and partly of brick, roofed with slate, consisting of cowsheds, piggeries, barn, stable, tool-house, &c.

"In a Reformatory School I think there is no occupation that tends to influence a boy's mind in the right direction better than farm-work. As a rule, the boys admitted come from close and unhealthy neighbourhoods, where they see little but depravity. We find that field and garden work has a very beneficial effect upon such cases. The boys discharged from this Reformatory, who have taken an interest in farm-work during their detention, and have kept to the same work after leaving, have rarely been out of employment and very seldom relapsed into crime. Farm-work is the principal industry at the school. A few boys are employed occasionally in repairing clothes.

"I feel sure that the education in a Reformatory School can compare favourably with the education given in an ordinary elementary school.

"It would be well to have an industrial department in every village school, but this is at present impossible for lack of funds. I regret to say that the low price of all agricultural produce is telling severely on the finances of our school at Tiffield.

"Rev. John Brown,
"One of the Secretaries,
"*Tiffield Reformatory School.*"

The chief remark with reference to this Reformatory that I need make is, that I witnessed an attempt there to make the boys conversant with the use of a steam threshing-machine. Of course they did not feed the machine or have anything to do that would involve the possibility of danger; but as in other Reformatories I had seen boys using the flail, this new experience struck me as being an attempt at a somewhat higher technical education. Still, as I was informed by the Rev. J. Brown, very few of the boys, except those who emigrate, continue farming after they have left the school; most of them go to Yarmouth and become fishermen. In this case, as in most others, the boys are hired largely at times of pressure by neighbouring farmers, earning 1*s.* each per diem, but taking their own food with them. The land is well cultivated, but would doubtless be more productive if there were more capital available for the purchase of stock. Under the present system, cattle are either bought or taken in to winter, so as to tread the straw into manure. The superintendent of this school joined with others in his position in stating that the boys now received are younger and smaller

* Less boy's labour, the amount is 331*l.* 10*s.* 3*d.*, as stated in Table II.

than those who were formerly sent. The district around Northampton has a character which may to some extent account for the low educational state of the inmates in 1884, viz., 3 in Standard Five, 6 in Standard Four, 5 in Standard Three, 15 in Standard Two, and 9 in the First Standard.

XII.—North Eastern Reformatory (Northumberland*).

"The average number of boys is 176. The boys come generally about the age of 12 to 15, and leave at about 17 to 19. They are not received as a rule unless on commitment for a second offence, or as being reported of very bad character. As to their future, 77·4 per cent. of those discharged within the last three years are doing well, as compared with 70·8 per cent. in 1882, 72 per cent. in 1881, and 75·8 per cent. in 1880. In no year during the history of the School has there been a more favourable return. As no regular information is obtainable after the third year from the date of discharge, it is not possible to say what proportion of boys are finally reclaimed; but as far as can be ascertained from their condition within the first three years following their discharge, it appears that the average number reclaimed in the 25 years of the School's existence has been 72 per cent. Agriculture is the principal work of the school, and about 115 to 120 boys are daily employed on our own farm, or on hire to neighbouring farmers. The only payments made are rewards for good behaviour on the farm, or at other industries, about 2*d.* per week. There is no gardening, &c., by way of recreation. The rest of the boys are at trades:—brickmaking, tailoring, joiner, smith, &c. The area of permanent grass-land is 315 acres; of arable land, 183 acres; and of garden land, 2 acres; and the rent under the above heads is 450*l.* Sheep and cattle are reared and sold; or bought and fatted off. A few horses are reared. There is a dairy of 10 or 12 cows for the use of the school. The corn is consumed in the school, also turnips, potatoes, &c. Some hay is sold. A great deal of town manure is used on the land, which is very heavy. Sundry vegetables and fruits are grown for the school use. The payments or bonuses to inmates are about 30*l.*; to ordinary labourers, 317*l.* 19*s.* 4*d.*; to bailiffs or other superintendents, 60*l.* The ordinary four-course system is followed on the arable land. The green crops are only turnips and potatoes, and there is always a proportion of bare fallow. The cultivation, where suitable, is mostly by spade. Wheat, oats, and barley are grown. The live-stock in December, 1884, consisted of horses, 10; cattle, 84; sheep, 205; and poultry varying in number. The produce sold off the farm consisted of 908*l.* 12*s.* 11*d.* worth of live-stock in the open market at various prices. Hay and straw, 61*l.* 12*s.* Hay at 5*l.* 5*s.* per ton; straw at 2*s.* per truss. Potatoes, 39*l.* 16*s.* 5*d.*, at 56*s.* per ton. The supplies to the school at various market prices were: wheat, 321*l.* 6*s.* 9*d.*; meat, 92*l.* 17*s.* 2*d.*; wool, 29*l.* 6*s.* 8*d.*; vegetables, 76*l.* 17*s.* 4*d.*; milk, 275*l.* 3*s.* 7*d.* The farm-buildings are spacious and suitable, with stables, cow-byres, loose boxes, straw-yards, cart-shed, straw-barns, &c., and all built in brick and stone by the inmates of the Reformatory, the cost being partly advanced by the landlord. These are built in a style above what is usually found on such farms. There is no dairy, properly so called, but all the milk is used, as milk, in the school."

In their Report for the year 1884, the Committee state:—

"The various trades carried on in the school have been conducted as usual, and, even where no special handicraft has been thoroughly acquired, have

* This Reformatory is situated at Netherton, near Morpeth.

afforded valuable industrial training. The out-door occupations upon the farm have not only been found conducive to the health and strength of those so employed, but the ordinary processes of husbandry, the care of stock, and the cultivation of garden ground, cannot fail to have a beneficial influence upon their general intelligence and usefulness.

"It will be observed that only small profit is derived from the various industries followed; but the Committee have always endeavoured to act upon the principle enforced in the Report lately issued by the Commission on Reformatory and Industrial Schools, viz., that such industries should be encouraged as are most likely to be useful in after life; and that the profits of the inmates' labour should be a secondary consideration.

"As some remarks have been made during the past year in public, by a high authority, at the expense of the North-Eastern Reformatory, as being a purely Agricultural School, and therefore of little value as a Training Institution for boys who have to earn their living in after years by their labour, it may be interesting to show the average disposal of the inmates on a working day:—

Employed in bricklaying and masons' work ..	5
" brick-making	13
" carpentering	8
" shoemaking	7
" tailoring	12
" as blacksmiths	10
" about the house	10
" on the farm	85
" on hire	30

"It is found in practice that boys, on leaving the school, do not, as a rule, continue to follow the trade or occupation to which they have been trained. This is partly due to the fact that they necessarily obtain their discharge before they have had time to become thorough proficients in any handicraft; and partly to the fact that the wages for unskilled labour, where only intelligence and habits of industry are required, offer an inducement to them to abandon a trade of which they cannot at once obtain the full rewards. But even in such cases the Committee are convinced that the training has not been thrown away, but, on the contrary, has been most valuable, and is a system to be maintained and developed."

"There are no agricultural employments beyond ordinary farm-work, except brick and tile-making. A good deal of draining has from time to time been done by the inmates, using our own tiles. The mass of the boys are of course employed in digging, &c., but certain of them plough, harrow, go with cart and horse, feed cattle, help with the milk cows, assist as threshers, cutters, &c., under the general superintendence of experienced farm servants.

"I have not the means of comparing the educational results obtained at a Reformatory with those obtained at ordinary Board Schools, not having at present any control over or access to Board Schools; nor do I well see how such results can be accurately compared, while the system of inspection and the status of the teachers is so different in the two cases contrasted. But from my past experience in National and Industrial Schools I have come to the conclusion that elementary education in Reformatories *need not* suffer, if it ever does, by combination with practical work. That is to say, from elementary instruction in Reformatories, where practical work is combined with school teaching, as good results should be expected as from ordinary elementary schools, *ceteris paribus*; and for these reasons:—the time, in our Reformatory, and I presume in others also, which is given to religious and

secular teaching *in the year* amounts to as much as is averaged by the attendants at ordinary elementary schools. We devote 1118 hours in the year to instruction; full attendance in an ordinary school (which is only attained in a very few cases) amounts only to 1125 hours.

"The regularity of the attendance, the sufficiency of proper food, the habits of discipline, the general health of the boys, and the familiarity of the teacher with their abilities and dispositions, are conditions which ought to have a bearing upon the results in favour of Reformatories as compared with other schools.

"But on the other hand there are difficulties—some inseparable from the very nature of Reformatories, some belonging to the system, which interfere with educational results. The boys have, as a rule, been neglected, and come to the school very ignorant and less capable of learning than at an earlier age. Amongst them are more than the average of low intelligences. The differences in age, ranging from 10 to 19, make classification very difficult, and the annual advance from standard to standard not easily attainable. The Reformatories, moreover, lie outside the ordinary stream of elementary education, and the teachers, however zealous in their work, have not necessarily had the professional training that is required in other schools, and are less in touch with the educational life of the day. The system of inspection, though thorough and adapted to its objects, does not bring the schools directly into comparison and competition with other elementary schools. It is natural to expect that after a real day's work at farm or other labour, boys will be weary and stupid for evening school, and probably this is the case with some; but we find their energies are not altogether exhausted, because when any extra labour is required in the evening, as in hay-making or harvest, all, with few exceptions, will volunteer for more outdoor occupation rather than rest in the school-room.

"My conclusion is that if the Reformatories could be ranked with other elementary schools as to the qualifications of the teachers and the assessment of results, in cases where the practical work can be so arranged, either by its character or the time given to it, as to be not too exhaustive, the attainments of the boys should be as satisfactory as they would be for the same boys in ordinary day-schools.

"R. R. Redmayne,
"Secretary, North-Eastern Reformatory,
"*Morpeth, Newcastle-on-Tyne.*"

The foregoing answers by Mr. Redmayne, the Secretary, are so full, that they leave very little for me to add. The size of the farm is out of all proportion to the requirements of the school; and as 315 acres are in poor grass, its stocking is a matter of considerable financial importance. As a rule, store stock are bought by a commission agent, and sold in the same way or by auction. At one time the manufacture of agricultural implements was a considerable industry at the school, as is still testified by the extensive workshops now only partially devoted to repairing them. This alteration of practice has not been chosen by the managers, but is an eloquent testimony to the prevailing agricultural depression. The old customers of the implement manufactory have for some years been unable to purchase new implements, and have found difficulty in providing money for the repair of their old ones. One curious

feature of this institution should be specially noticed, namely, that connected with religion. In England and Wales there are about four Reformatory Schools specially for Roman Catholic boys, but not one for Jewish children. However, at Netherton all religions are at home; the Roman Catholic boys have their own schoolmaster, who gives them instruction in their own religion; the Rabbi comes occasionally to examine the Jewish boys, who are sent unleavened bread for Passover, from whose diet pork is excluded, and who do not work on their Sabbath, as an additional payment of 1*s.* per week for each boy is made to the school on that account. It is believed that this is the only Reformatory in England to which Jewish boys are sent. The educational state of the boys is reported as being "a little backward;" 14 boys were in the Fifth Standard, 30 in the Fourth, 48 in the Third, 50 in the Second, and 28 in the First.

XIII.—The Suffolk Reformatory for Boys.

"Eighty boys are generally maintained. Their ages when admitted vary from 12 to 16 years (only special cases are admitted under 12 years). Boys, when discharged, generally turn out well; about 10 per cent. are re-convicted. Agricultural operations are carried on as a means of instruction and physical exercise, each boy receiving 3 hours' instruction daily. Small plots of garden ground are given to boys as a reward for good behaviour, &c. The farm includes 17 acres of permanent grass-land, 40 acres of arable, and 2 acres of garden. The total rent, including the school and farm premises, is 99*l.*, of which 81*l.* is charged to the farm. The land is cultivated under what is termed the 'Four-course Shift,' viz., 2 straw and 2 root or green crops within the 4 years. The live-stock consists of 4 horses (which are used on the farm), 6 cows, 2 bullocks, 8 calves, and 70 pigs; no sheep are kept. The farm-buildings are very suitable for the purpose, most of them being nearly new.

"Agricultural employment must have a good influence on the mind; no one, however bad, could at times fail to see the Hand of the All-wise and Wonderful Providence working around him. The boys are taught practical farming, and there is a dairy attached to the school, all operations in which (butter-making, &c.) are carried out by the boys under proper supervision.

"We have not found that the education of the school suffers in the least by its combination with practical work; in fact quite the reverse, and I am confident that the results obtained here would compare very favourably with any Board School in the district.

"Frederick W. Gill,
"Superintendent,
"*Thorndon Reformatory, Eye, Suffolk.*"

The Superintendent of this Reformatory succeeded his late father three years ago, and the state of the school and the farm seemed to me highly creditable, and a testimony to the success with which he has carried out the family traditions. It will have been noticed that a large head of stock is kept, but I should add that, of the four horses, three are brood mares.

Most of the land is *ploughed*, and this accounts for so many horses being kept, if for nothing else, especially as in the winter there is plenty of carting to be done. The calves are reared and the best heifers kept to replace the cows, while the bullocks are converted into beef at about two years old. The young pigs are sold to London as porkers. The boys milk the cows and do the churning, but a woman skims the milk. In the middle of last September the butter was fetching 1*s.* 6*d.* to 1*s.* 7*d.* per lb. As most of the work done by the boys is agricultural, it is sometimes difficult to provide them with wet-weather jobs, such as wood-chopping, &c., to keep them out of mischief. So I witnessed a number of them threshing out beans with stout sticks! The most astonishing feature about this Reformatory is the net cost per head of the boys, viz. 13*l.* 4*s.* 7*d.*, or more than 25*s.* per head less than the Government grant of 6*s.* per week, and only about two-thirds the usual cost. Mr. Gill explains this as being largely due to the allowances to officers being commuted into money payments. All the boys work an hour before breakfast; then they are divided into two shifts, one of which is at school during the morning and the other in the afternoon, advantage being taken of Sunday to change the morning to the afternoon shift for the next week, and *vice versâ.* The state of the boys' education is reported as "satisfactory." There were 22 in the Fifth Standard, 19 in the Fourth, 18 in the Third, 13 in the Second, and 4 in the First. The parents of some of the boys are agricultural, and they obtain agricultural employment upon leaving; but town boys go back to the towns, and many emigrate.

XIV.—The Philanthropic Society's Farm School, Redhill, Surrey.

"There are about 300 boys in the school. They enter at any age under 16, and can stay from 3 to 5 years. Their past history consists chiefly of ignorance, vice, and crime; the future career of about 86 to 90 in every 100 is earning an honest livelihood at home or in the Colonies—about half in each. Agriculture is the staple trade of our school, other trades being only engaged in for the purpose of supplying ourselves with boots, clothes, bread, &c., &c. The boys receive small payments—chiefly on the system of piece-work—amounting in the aggregate to about 178*l.* per annum. Plots of garden are given to a certain number of boys, and are much valued.

"The land comprises 64 acres of permanent pasture, 216 acres of arable land, 17 acres of market garden, and 21 acres of officers' gardens, buildings, &c. Of the total, 57½ acres are rented at 91*l.* 8*s.* 7*d.* per annum (including insurances), the rest is freehold of the Philanthropic Society. The payments for labour are 178*l.* to boys; 125*l.* and house, &c., to bailiff; 65*l.*, &c., to the market-gardener; six farm-labourers at 46*l.* 16*s.*; carter and cowman at 52*l.* each. The rotation is chiefly the four-field system, and the live-stock consists of 5 horses, 48 cattle, 100 sheep, 70 to 100 pigs, 200 to 300 fowls of various

kinds. The value of the produce sold off the farm in 1884 was 1793*l.* 16*s.* 5*d.*; besides a total of 1004*l.* 10*s.* 6*d.* utilised for school purposes. A dairy, conducted on the ordinary system, is attached to the school.

"Agriculture has a wonderful effect in reforming boys, especially town boys. The moral and physical improvement effected by it in even a few months must be seen to be appreciated. Contact with the soil appears to act as a moral deodoriser. It is also the best preparation for Colonial life. Our boys who emigrate do well and prosper. They are much sought after by Colonial farmers.

"I do not think that elementary education suffers at all in our school by its combination with practical work. On the contrary, the one appears to help on the other. Taking the whole year through, we give more hours to education annually than the Board Schools. But it is to be remembered that many boys come to us at the ages of 14, 15, or 16, knowing practically nothing, and it is a very difficult matter to push those forward—much more so than if we had to deal with them earlier in life. Therefore, when a boy leaves a Reformatory still backward for learning, it should be ascertained what was his age and the state of his education on admission, before the Reformatory is blamed for neglecting his education.

"REV. ARTHUR G. JACKSON,
"Resident Chaplain and Director,
"*Philanthropic Society's Farm School, Redhill, Surrey.*"

The large farm of nearly 300 acres attached to this really remarkable establishment was still visibly suffering from a long course of mismanagement. My inspection was made on May 31st, 1885, and the present Farm-bailiff, who had then been in office only fifteen months, explained to me the way in which he hoped to get rid of his inheritance of twitch by a laborious system of spade-digging and hand-picking. The portions of land which had already been subjected to this process were comparatively clean, and the Philanthropic Society are to be congratulated upon having secured the services of a Farm-manager who does not look with favour upon a partnership in the soil in which Twitch is the head of the firm. The market garden has recently been increased from 6 to 17 acres in extent, and if success attends this development of vegetable culture its extension will be continued by degrees, as it provides healthy and intellectual employment for the more intelligent boys. When engaged in digging the heavy land the boys are paid a farthing per rod, and at this rate the stronger ones can earn as much as 9*d.* per week. Of the cattle, from 35 to 40 are milch cows; and the boys, who are taught all farming operations, do the milking, and assist in the dairy. At the time of my visit, the butter was being sold at 1*s.* 7*d.* per lb. to persons who sent for it, and the remainder was sent to grocers in Redhill at the same price, *minus* 2*d.* per lb. commission. The skim-milk is mostly used in the school. Although agriculture is the chief, and indeed almost exclusive, employment, yet tailoring, shoemaking, and carpentering are taught, so that the needs of the

establishment may be met by the boys themselves, and those who elect to go to Canada or Natal are specially instructed in order to be able to turn their hands to those trades for their own purposes. In these colonies the Philanthropic Society has resident agents who not only report on the progress of the "old boys," but who also provide for the reception and employment of new-comers. The organisation of this Reformatory is upon the system founded by M. de Metz at Mettray, which has been already described. At Redhill there are five houses; but they are so far apart that the responsible chief has not the same control over the "Heads of Houses" as is so easily exercised at the French establishment. The general education of the boys receives due consideration, and in the winter an additional amount of schooling to that provided for by the Act is given. Most of the boys at this Reformatory come from the slums of London; and in going over the farm with the excellent Resident Chaplain, who is at the head of the whole establishment, I was much struck with his intimate knowledge of the career of any boy who attracted my attention; and, at his request, I often tested the accuracy of his statements. This personal intercourse with such young miscreants, as some of them were, has a great effect upon their minds, especially when, as in this case, it is associated with a knowledge of their own language. The Rev. Mr. Jackson has been "fond of thieves" all his life, and he speaks the "thieves' slang" to all appearance as fluently as the Queen's English.

XV.—Stoke Farm Reformatory School, Worcestershire.

"There are about 80 boys maintained in this school; their average age on entering is 13, and on leaving 16. Nearly all have been convicted of crime more than once before they are received; three-fourths come from Birmingham, and most of the rest are town boys; many of them of the 'City arab' class. About 75 per cent. turn out well. A considerable number drift into the army, which is not encouraged by us. Farm labour from 9 A.M. to 5 P.M. is used as a wholesome discipline. Boys whose crimes have often arisen from idleness and slovenly habits cannot *shirk* much when they are double digging under the eye of a competent man; and if they can be taught to work steadily, a great point has been gained. The physical result of the out-door life, hard work, and sufficient food on these half-starved town boys is most marked. We have only had four or five deaths in 30 years. Plots of garden are given to the greater number of the boys, being withheld from those whose conduct is unsatisfactory. No payment is made to the school inmates employed in farm labour. There is no permanent grass. Purely arable land is about 35 acres in extent; and garden, more or less mixed with arable and orchard, is about 35 acres. The rent paid for 75 acres is 320*l.* per annum, of which about 100*l.* is referred to school premises and four cottages. The bailiff is paid 80*l.* per annum; two gardeners, 70*l.* each; waggoner, 18*s.* a week; assistant, 40*l.* and board. The superintendent does the correspondence and book-keeping. Bonuses to inmates are trifling in amount. The 35 acres of arable land carry

wheat every other year, the alternate crop being potatoes, peas, clover, kidney beans, mangolds, swedes, and vetches. The land is not first-rate, but the deep-spade cultivation has given the following crops of wheat per acre:—1872, 34 bush.; 1873, 48; 1874, 48; 1875, 37; 1876, 40; 1877, 30; 1878, 56½; 1879, 31; 1880, 45; 1881, 37; 1882, 46; 1883, 39; 1884, 44; average, 41. The live-stock consists of 3 horses, 4 milking-cows, and about 60 pigs. In 1884, the sales consisted of wheat, butter, &c., 118*l.* 9*s.* 6*d.*; vegetables and fruit, 642*l.* 13*s.* 2*d.*; live-stock, 157*l.* 16*s.* 2*d.* The supplies to the school were:—meat, 81*l.* 2*s.* 6*d.*; vegetables, 25*l.*; milk, 62*l.* 8*s.*; sundries, 4*l.* 16*s.*; making a total of 1094*l.* 5*s.* 2*d.* The largest items were:—apples, 33*l.*; kidney beans (3½ acres, not sticked, but pinched short), 81*l.*; celery, 15*l.*; black currants, 20*l.*; gooseberries, 38*l.* (in 1883, 93*l.*); parsnips, 28*l.*; green peas, 62*l.*; potatoes, 94*l.*; plums, 98*l.*; raspberries, 48*l.*; strawberries, 33*l.*; tomatoes, 12*l.* (from glass-house).

"Our boys are four years older than those in ordinary country schools, so that the education in the two is scarcely comparable. The Government insists on our giving a minimum of 16 hours schooling per week, and this is sufficient to place our education on a par, I should think, with that in an average country school.

"Technical instruction in agriculture, in the sense in which it is understood in the Swiss primary schools, it is not in our power to give. The only way in which the boys' farming training is turned to account is by placing them when they leave in districts like North Derbyshire, where indoor servants are kept, and where they have plenty of chances of advancement and of becoming farmers. I am sorry to say that a large part of even these boys get discontented after a time, and come back to a town life. The prospects of an agricultural labourer in this part of England seem to me to be almost hopeless at present. Market-gardening in Worcestershire, though often profitable, is not a satisfactory trade for our boys. It is very irregular and speculative, and does not present the moral advantages of straightforward farm-work. The market-gardeners have apparently special temptations to drunkenness. The farm boys are also employed in picking pebble stones off the land for the roads, and in working a sand and gravel pit on the farm. Other boys are taught tailoring, shoemaking, and baking.

"Joseph Sturge,
"Hon. Sec.,
"*Birmingham.*"

Of the 80 inmates of this school, 60 are employed on the land, the remainder being taught various indoor trades. On the purely arable land, cereals alternate with market-garden crops, while the orchard-land is occupied with apple, pear, and plum trees, having bush-fruits, such as gooseberries, raspberries, currants, &c., between and beneath them. Mr. Pease's description above gives all the agricultural information necessary, so it only remains for me to add that at the 1884 educational inspection 18 boys were in Standard Five, 22 in Standard Four, 16 in Standard Three, 22 in Standard 2, and only 2 in Standard One. The Manager, Mr. McGilchrist, is a strict disciplinarian, and it will be seen by the Tables I. and II., pp. 230–233, that this school, with its orchard, its market-garden, and its heavy crop of wheat, presents a good economical as well as educational result.

XVI.—The Castle Howard Reformatory Farm School, Yorkshire.

"The average number of boys maintained in 1884 was 80. Boys under 12 are not admitted unless they have been convicted more than once. The average term of detention in the school is about 3 years, but we always ask for the maximum sentence, viz. 5 years, which enables us to permit the boys to go out on licence, subject to satisfactory conduct. The inmates come chiefly from the large towns in the North and East Ridings. They have all been convicted of crime more than once, or are of known criminal habits. They go, on discharge, chiefly to farm service, to which the greater part settle, becoming ultimately foremen, &c. The inmates are employed chiefly on the farm or by neighbouring farmers. A system of rewards by marks, which carry a fixed money-value, is carried out for work on the farm. Boys out on licence receive the whole of their wages, and pay for the clothing supplied from the Institution at cost price. Their washing, &c., is done at the school gratuitously, and they come on Sundays to change linen, attend chapel, Sunday school, &c., returning to their places on Sunday evening or Monday morning. Plots of garden ground did not answer, partly from local causes. The farm consists of 40 acres of permanent grass, 53 acres of arable land, and 2 acres of garden, held at a total rent of 145*l.* 10*s.* The payments to inmates amounted to 33*l.* 2*s.* 11*d.*, and to bailiff and other superintendents, 121*l.* 4*s.*, making a total of 154*l.* 6*s.* 11*d.* The four-course system of husbandry by spade-labour is adopted. The following head of live-stock are kept:—

Horses for Agricultural purposes	1
Cows	5
Other cattle	11
Sheep	23
Lambs	33
Pigs	23
Poultry	60

"During 1884 the following amounts were realised for farm produce:—

	£	s.	d.	£	s.	d.
Live-stock (sales for cash)	209	12	0			
Corn " "	79	8	0			
Milk, &c. " "	6	18	3			
				295	18	3
Meat (supplies to school)	36	6	6			
Vegetables " "	59	12	6			
Milk, butter, &c. "	51	2	4			
				147	1	4
Total				£442	19	7

"The farm-buildings are good and substantial, but requiring re-arrangement and enlarging. After thirty years' experience, I conclude that, as a moral agent, farm-life is one of the best for boys of the class with whom we have to do. So far as future advancement goes, I believe it to be also valuable. It induces habits of quiet and intelligent observation, industry, obedience, punctuality, dependableness, self-reliance, and self-respect. Where, in after life, it has been abandoned for more advanced duties, I have always found the boys able to compete successfully. Our dairy is only very small, but some of the boys learn to milk, and to wait upon the cows and calves, and also to churn. This experience gains them ready employment on the neighbouring farms, when they are ready to go out on licence. Besides cultivating our farm, the

boys do a good deal of work for our neighbours: planting and lifting potatoes, hoeing and pulling off turnips, cleaning corn, harvesting, &c. A considerable number also live with farmers as hired servants, and gradually rise to the higher position of foremen and hinds. The demand for our boys generally exceeds the supply.

"I conclude, from my experience, that our boys not only do not suffer but gain by the judicious combination of school work and field labour.

"The uses of labour to society are its productiveness. These are also its uses to the individual. It is in its restraints, its reflective influence upon character, that labour is chiefly valuable in a Reformatory. Three or four hours out of every four-and-twenty during three years—and we have no vacations—afford sufficient time for an average boy of from twelve to fifteen years of age for learning to read, &c., write, and count. Considering their previous habits and physique, I believe greater intellectual progress is possible under our combined system than under that of an ordinary elementary school.

"The children in an ordinary elementary school are of a different class, with which ours can hardly be compared. Ours are the waifs and strays, the truants, the incorrigible, and the vicious. Nevertheless, our general educational standard I believe very nearly, if not quite, attains to that of an ordinary elementary shool. With regard to the general question of combined elementary education and practical work, I am of opinion that it would be highly advantageous to the children of the labouring classes in agricultural districts if they could receive some practical instruction in school; the girls in the rudiments of housekeeping, and the boys in those of ordinary farm work. Nothing can be more painful to witness than the helplessness of young untrained girls on going to service, or, for that matter, than that of their mothers also in their cottages, especially in times of sickness and distress. The scanty earnings of the family are frittered away from sheer ignorance of the simplest rules of domestic economy; and nothing but the genuine pure country air in which they pass the day could save whole families from the natural consequence of their ignorance of the most elementary sanitation.

"If a boy, before he is old enough to go to farm service, could be taught to milk a cow and tend a pig intelligently, if he could put the gearing upon and guide a horse, if he had learnt ever so little about sheep and cattle and about the nature and character of soils, if he knew what weeds should be buried and what should be burnt, and a few other such practical elements of his daily life on the farm, his value would be enhanced five-and-twenty per cent. to begin with.

"All these and many other simple practical lessons might easily and advantageously be taught in an ordinary elementary day-school, to the relief of much monotony.

"Richard G. Fish,
"Resident Chaplain and Superintendent,
"*Castle Howard Reformatory Farm School, Welburn, York.*"

From my point of view this Reformatory School is one of the gems that I met with. Here one found a farm excellently managed, and the boys' technical instruction so well organised and carried out, that it enabled them to become foremen and Farm-bailiffs in their own county in after life. It is true that the money obtained for the farm-produce is, acre for acre, very much less than that at Stoke and other Reformatories which are near large towns, or where large quantities of fruit and early

vegetables can be grown. But the older boys can be trusted to go singly to work at farms in the neighbourhood, instead of going in gangs. And as to the results of the elementary education given, Colonel Inglis found in 1884 that 16 were in Standard Five, 15 in Standard Four, 22 in Standard Three, 11 in Standard Two, and 5 in Standard One. As an indication of the "tone" of the establishment, I may add that the boys have their cricket-club, football-club, book-club, &c., largely kept up by their own subscriptions.

XVII.—Leeds Reformatory School, Adel, near Leeds.

"On an average 150 boys are maintained. They are not admitted under 12 years of age nor over 16, and are boys of criminal habits, who have been previously sentenced to imprisonment for felony. Situations are found for them when they leave the school, and their future career is carefully watched. The land attached to the school consists of 15 acres of wild moor-land, part of which has been reclaimed by the boys' labour; about 3 acres of it is grass, used as boys' playground, and about 7 acres is market garden. The boys are rewarded according to the number of marks earned. No plots of garden ground are given to the boys. 10*l.* a-year rent is paid for the 15 acres, and 60*l.* for school-buildings. Two men are employed; one receives 36*l.* a-year, board, and lodging; the other 1*l.* per week, with house, food, and light. Two horses and five pigs are kept. The produce sold in 1884 realised 114*l.* 12*s.* 5*d.*; and that supplied to the school in 1884, 27*l.* 4*s.*, making a total of 141*l.* 16*s.* 5*d.* 70*l.* was received for horse labour supplied. The farm-buildings consist of a shed and stable, with hay and straw loft.

"Most of the boys, committed from manufacturing districts, return to a town life; very few stay in farm situations.

"I should say that the elementary education of a boy in a Reformatory suffers very little in combination with practical work. Of course with the time at our disposal (about 3 hours daily) what is attempted beyond the "three R.'s" can be but superficial. The average age of the boys admitted here is 14, and the importance of hard work as being the primary agent in forming a boy's character cannot be too fully recognised.

"C. G. Twigg,
"Superintendent,
"*Leeds Reformatory School, Adel, near Leeds.*"

The quantity of land attached to this school being so small, the market-garden work employs only a small proportion of the boys, many of whom, however, work for farmers on licence. All the necessary information is given above by Mr. Twigg, but I should add that the results of the 1884 educational examination were "satisfactory and creditable."

XVIII.—The Calder Farm Reformatory School.

"110 boys are maintained on the average. Their ages on admission are from 10 to 15 years; average 13 years. Ages on leaving (on licence or final discharge) range from 14 to 19 years; average, 16½ years. All boys admitted

here have been convicted of crime. During the years 1881, 1882, 1883, and 1884, 119 boys were finally discharged. At the end of 1884, I find that of these, 51 are employed as farm-servants, labourers, and teamers; the rest are accounted for as follows: 16 soldiers, 13 mechanics, &c., 8 factory hands, 2 book-keepers, 6 colliers, 1 sailor, 3 tailors, 2 shoemakers, 3 hawkers, 3 unknown, 10 re-convicted, 1 dead. Out of the whole (119) 105 are found to be doing well; but of the 51 employed as farm-servants, labourers, &c., none have been re-convicted. About two-thirds of the boys are employed on the farm and garden, or in agricultural work on hire; the others are employed as tailors, shoemakers, joiners, &c. All the boys are given a small wage, fixed by a system of marks, which are awarded by the labour-master in charge. At the beginning of each week a mark sheet is given to each labour-master (specimen annexed, p. 208), and is filled in daily with marks, according to the amount of work done.

"Marks have a money value, and at the end of each week the amount due is carried to each boy's ledger account. A sheet is also made out weekly (copy annexed, p. 209), showing the number of marks earned by each boy, with money value, and this is hung up in the school, and remains till replaced by another for the following week; but the amount is subject to deterioration by negative marks, given on account of work being imperfectly executed or of misconduct. The value of the marks is calculated as follows: —No value is attached to marks less than 9 in number, but 9 marks count for $\frac{1}{2}$*d.* in the First Class and for $\frac{1}{4}$*d.* in the Second; then every additional 3 marks is worth $\frac{1}{2}$*d.* in the former case and $\frac{1}{4}$*d.* in the latter. Plots of garden ground used to be given to boys for gardening, but were discontinued on account of boys pilfering produce from one another. However, every encouragement is given to boys by extra rewards, &c., for striving to excel in any branch of industry. The farm consists of 80$\frac{1}{2}$ acres of permanent grass, 34 acres of arable land, and 5 acres garden, all held at a rent of about 24*s.* per acre, without distinction. The cash paid in 1884 included 22*l.* 12*s.* 8*d.* as rewards; placed to boys' credit, about 25*l.*; 136*l.* 19*s.* 6*d.* to labourers, including butter, vegetables, potatoes, &c.; 69*l.* 14*s.* to bailiff, including butter, vegetables, &c.

"The farm, as well as the other departments, is under the general management of the head-master; all farming operations are carried out by the farm bailiff, who occupies a house on the homestead, and his wife attends to the dairy. The cultivation of the farm and garden is to a great extent done by the spade, which affords healthful and useful employment for the boys. Trenching the ground to a depth of from 1 ft. to 2$\frac{1}{2}$ ft. has been largely practised here, with the most satisfactory results. The rotation pursued is: *First* year, green crops (turnips, potatoes, mangolds, &c.); *Second* year, wheat generally; *Third* year, clover or oats, in the case of clover failing; *Fourth* year, on clover-lea wheat, or else oats, according to the previous cropping.

"Two horses are kept, occasionally three; milch cows vary from 12 to 15 in number; heifers under 2 years old and stirks, about 8; grazers taken in, 10; pigs of all ages, about 18. The value of the live-stock sold in 1884 was 136*l.* 15*s.* 3*d*; produce sold, wheat, 15*l.* 2*s.* 9*d.*; milk and butter, 164*l.* 5*s.* 7*d.*; vegetables, potatoes, &c., 73*l.* 8*s.* 9*d.*; agistment, 14*l.* 19*s.*; sundries, 5*l.* 1*s.* 10*d.* For school purposes: pork and bacon, 35*l.* 8*s.*; milk and butter, 85*l.* 1*s.* 10*d.*; potatoes, &c., 28*l.* 16*s.*; sundries—coal, leading, &c., for Institution, 32*l.* 10*s.*; supplied to officers as rations: butter, vegetables, &c. 37*l.* 5*s.* 8*d.*, making a total of 628*l.* 14*s.* 8*d.* All charges (actual or estimated) are regulated from time to time by market prices. Part of the farm-buildings are old, but on the whole the buildings are fairly adapted for purposes of farming.

Officer's Return of Labour Marks, etc., for Week ending May 30th, 1885.

No.	Names of Boys.	Monday.		Tuesday.		Wed.		Thursday.		Friday.		Saturday.		Amount for Labour.	Total Disorder Marks.	Amount for Labour due.	Wage.	Extra.
		Labour.	Disorder.	Labour.	Disorder.	Labour.	Disorder.	Labour.	Disorder.	Labour.	Disorder.	Labour.	Disorder.					
1		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	..
2		5	..	3	..	4	..	4	..	5	..	3	..	..	..	24	1½	..
3		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	..
4		5	..	5	..	5	5	5	..	5	..	5	5	30	10	20	2	..
5		5	..	5	5	5	..	5	5	5	..	5	..	30	10	20	2	..
6		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	..
7		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	6
8		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	3
9		4	..	5	..	3	..	5	..	4	..	3	..	..	..	24	1½	..
10		5	..	4	..	3	..	3	..	4	..	5	..	..	..	24	1½	..
11		4	..	4	..	3	..	5	..	3	..	5	..	..	..	24	1½	..
12		4	..	4	..	5	6	3	..	4	5	4	..	24	11	13	½	..
13		3	..	4	..	2	..	3	..	2	5	4	..	18	5	13	½	..
14		3	..	3	..	4	..	2	..	3	..	3	..	..	..	18	1	..
15		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	6
16		3	..	3	..	3	..	4	6	2	..	3	..	18	6	12	½	..
17		4	..	5	..	3	..	4	..	4	5	4	..	24	5	19	1	..
18		2	..	4	..	5	6	5	..	4	..	4	..	24	6	18	1	..
19		3	5	2	..	4	..	3	..	3	5	3	..	18	10	8	0	..
20		4	..	2	..	9	..	5	..	2	..	2	..	..	..	18	1	..
21		5	..	3	..	4	..	3	..	5	..	4	..	..	..	24	1½	..
22		5	..	5	..	5	..	5	..	5	..	5	..	..	..	30	4	6
23		5	..	5	6	5	..	5	..	5	..	5	..	30	6	24	3	..
24		3	..	4	..	2	..	3	..	4	..	2	..	..	..	18	1	..
25		4	5	3	..	2	..	3	5	2	..	4	..	18	10	8	0	..
26		2	..	5	..	3	..	2	..	4	..	2	..	..	..	18	1	..

Memorandum of Employment. Masters and Boys.

Monday, 25*th*.—3 farm boys, 2 house boys, 2 working with Mr. Vinton on hire, 1 hoeing beans, 1 minding pigs, 3 getting in hay and mangolds, 7 digging on garden, 8 cleaning meadows.

Tuesday, 26*th*.—3 farm boys, 2 house boys, 9 digging on garden, 5 digging in 21-acre field, 7 breaking clods.

Wednesday, 27*th*.—3 farm boys, 2 house boys, 5 digging on garden, 5 picking meadows, 11 breaking clods in 21-acre field.

Thursday, 28*th*.—3 farm boys, 2 house boys, 6 picking wicks, 8 breaking clods, 4 with Mr. Lockwood making rockery, 3 in garden.

Friday, 29*th*.—3 farm boys, 2 house boys, 8 filling and spreading manure, 9 breaking clods, 4 with Mr. Lockwood making rockery.

Saturday, 30*th*.—3 farm boys, 2 house boys, 9 filling and spreading manure, 9 half-day weeding corn, 3 half-day making rockery, 12 half-day recreation.

(Signed) R. Wilson, *Labour Master*.

N.B.—Labour Marks must be given in exact proportion to the real amount of work executed by the Boys. Disorder (or minus) Marks may be given on account of work being imperfectly executed, slovenliness in person or clothes, or any other irregularities.

Boys returning to the School for a time after being discharged, must be entered on the Labour Sheet, and accounted for (especially if working on hire) by the Labour Master to whose list they formerly belonged, but no Marks be given them.

CALDER FARM REFORMATORY SCHOOL, LOWER HOUSE.

LABOUR MARKS AWARDED to BOYS for the WEEK ending MAY 30, 1885.

No.	NAMES.	Class of Labour.	Number of Marks.	Negative Marks.	Marks due.	Money value.	Extra.
						d.	d.
1		1	30	..	30	4	..
2		1	30	5	25	3	..
3		1	30	..	30	4	3
4		1	30	6	24	3	..
5		1	29	..	29	3½	..
6		1	30	..	30	4	..
7		2	22	5	17	¾	..
8		1	29	5	24	3	..
10		1	30	..	30	4	..
11		1	30	..	30	4	6
12		1	30	..	30	4	1½
13		1	30	..	30	4	6
14		2	24	..	24	1½	..
15		1	30	5	25	3	..
16		2	24	..	24	1½	2
17		1	30	..	30	4	..
18		2	30	..	30	2	..
19		2	24	..	24	1½	..
20		2	24	..	24	1½	..
21		1	25	..	25	3	..
22		2	24	5	19	1	..
23		2	24	11	13	½	..
24		2	28	..	28	1¾	1½
25		2	18	5	13	½	..
26		2	18	17	1	0	..
27		1	29	..	29	3½	6
28		2	18	..	18	1	..
29		2	30	5	25	1½	..
30		2	28	..	28	1¾	..
31		2	25	5	20	1	..
32		2	18	..	18	1	..
33		2	18	..	18	1	..
34		2	18	10	8	0	..
35		2	18	..	18	1	..

"Here, with few exceptions, the boys on admission are turned on to the farm or garden to work, and, generally speaking, a marked improvement is soon visible as to their physical constitution. Morally speaking, we find that when the boys are most actively employed on outdoor work, as in hay-time and harvest, they are then most happy and settled, and few offences occur; altogether, outdoor work (if boys are thoroughly instructed and supervised) seems to have a softening effect upon their character. Many have attained considerable proficiency in the art of agriculture and gardening, and do a large amount of work on hire, and their employers generally insist upon their work being satisfactorily done. I consider this one of the best modes of training lads in field husbandry, and as fitting them for going out into the world skilled in such work. All household work (under proper supervision) is done by the boys, such as cooking, baking, and cleaning, also shirt making, washing, &c. This sort of work is mostly taken by the boys in turn.

"I do not think that the elementary education of children suffers at all

by their being detained in these institutions, but quite the contrary. Here the average age of boys on admission is about 13 years. Under the Education Act they could not have been compelled to attend an elementary school after having attained the age of 14 years, and, being of strolling truant habits as a class, very few of them would ever have entered the door of an elementary school again after attaining that age; whereas, being detained in a Reformatory School, about three years on an average, and receiving three hours' secular education per day, they not only make good progress in their learning, but it is kept up for a time much longer than if they had been at large; thus they certainly leave the Institution far better educated than they would otherwise have been.

"Incidentally, I may mention that at our last Government inspection (15th December, 1885), taking the school all round, 96 per cent. of the boys passed their examination in reading, writing (including dictation), and arithmetic up to the Fifth Standard, inclusive.

"John Hepple,
"Head Master,
"*Calder Farm Reformatory School, Mirfield, Yorkshire.*"

The foregoing account is so exhaustive that little remains to add. The system of marks illustrated by the two Tables is the same as that adopted at a large number of Reformatories. As at the Liverpool school, the garden-land is changed to farm, and a portion of the farm to garden from time to time. The boys are taught how to milk, and to perform other duties connected with the care and the feeding of animals. The inmates are divided between two houses situated about a quarter of a mile apart. As at other Reformatories, great difficulty is experienced in finding wet-day work; but here I saw what was to me a novel arrangement. It consisted of a large ship's windlass, fitted with a number of long handspikes; to these the boys' power was applied by a row of them at each spoke pushing, and a row opposite them pulling. On the day of my visit the power thus obtained was used to drive a threshing-machine. Mr. Hepple informed me that the farmers round about are not disinclined to take the Reformatory boys when they are discharged, and many of them work at farms on licence. As to the educational state of the school at the 1884 examination, 18 boys were in Standard Five, 24 in Standard Four, 31 in Standard Three, 28 in Standard Two, and 11 in Standard One. "The school-room work was creditable, and told of careful attention on the part of the teachers."

INDUSTRIAL SCHOOLS.

I.—The Boys' Farm Home, Church Farm, East Barnet.

"The average number of boys is 87. They are admitted from the age of 8 up to 14 years, and discharged at the age of 16. Only destitute boys are admitted, and such as are destitute from misfortune and not from the culpable

neglect of their parents. Their future careers vary very much,—domestic service, trade, or business, army, navy, &c., take most of them. A few emigrate, and these mostly take to agricultural work, while some take to agriculture at home. The boys are employed on the farm, each boy being occupied about 6 hours daily. A small monthly payment, varying from 4*d.* to 1*s.* 6*d.* is given as an encouragement. A few of the boys have small plots for the cultivation of flowers.

"The area of permanent grass-land is about 36 acres, of arable land about 9 acres, and of garden land 1 acre. The farm is the freehold of the Trustees of the Boys' Farm Home. The outlay for labour comprises payments to the boys at 4*d.* to 1*s.* 6*d.* per month pocket-money, two labourers at 22*s.* per week, and a farm bailiff at 35*s.* per week, with cottage, coals, gas, &c. Green and root crops for the use of dairy stock are mostly grown, with potatoes and cabbage for the use of the boys. There is no specified rotation, but grain crops are grown when it seems desirable.

"The following live-stock are kept:—Horses—4 in work and 5 foals at present. Cattle—12 milch cows, 1 bull, 7 heifers and calves. Pigs—8 breeding sows, 1 hog, young pigs varying from 40 or 50 to 1 or 2. Poultry—about 50 head.

"For the year ending December 31st, 1884, the amount realised for milk, butter, eggs, live-stock, and vegetables was 983*l.* 1*s.* 8*d.*, of which produce to the value of 46*l.* 8*s.* 4*d.* was supplied to the school. The buildings are mostly substantial, brick and slate-roofed, being suitable for their purpose, and consisting of cowhouses, stable, barn, piggeries, poultry-shed, cart-shed, and silo.

"Agricultural work, in my opinion, is specially suitable for the lads of our Reformatory and Industrial Schools from almost any point of view. Carried on judiciously, by which I mean not taxing the strength and endurance of a boy beyond his powers, nor exposing him unnecessarily to extremes of weather, it should result in that desirable combination, 'a sound mind in a sound body.' The constant physical exercise in the open air will develop the one, while the endless variety of occupation and subjects of interest in connection with it, wisely handled as a means of educating, should seldom fail in producing the other. For a boy who has to earn his living by labour, the lessons to be learnt on a farm are always useful, to such as emigrate they are invaluable. A well-managed farm is one of the best means of affording technical instruction, and, when properly utilised with that end in view, would certainly place the boys trained in it in a position far in advance of labourers who have had no similar advantages. Dairy operations are carried on here almost with the sole view of the production and sale of milk—a little butter is occasionally made. Most of the necessary work in connection with this is done by the boys.

"The conclusions I have arrived at are, that practical work by no means interrupts or even retards the *elementary* education given in Industrial Schools. I find no difficulty in moving on boys of ordinary capacity one standard a year in elementary subjects, even while devoting a fair proportion of time to specific subjects directly bearing on their practical training. To dull boys the practical training is the most useful part of their education; they do learn to use the faculties they are endowed with, instead of spending their time in a vain endeavour to develop powers they do not possess.

"JOHN BOWDEN,
"Head Master,
"*The Boys' Farm Home, East Barnet, Herts.*"

A comparison of the results obtained at this school with those described in the foregoing pages brings us face to face immediately with the question of the value of the raw material

P 2

to be dealt with, namely, the condition of the boys on their admission. Reformatory boys have all been convicted, generally twice, of grave offences, and many of them are hardened criminals when admitted into the schools; they are also for the most part as ignorant of what is termed book-learning as a block of wood. Most of the boys sent to Industrial Schools are on the verge of crime, if not actually criminals of a minor stamp; but at this school no boys are admitted who are not "destitute from misfortune." With boys of a higher moral order and some elementary book-knowledge, work of a higher class can be done; therefore this farm, situated on the verge of a fairly populous suburb of London, can be cultivated so as to produce articles, such as milk and butter, which are always in demand. The result is that in the year ending December 31st, 1884, the total value of the farm-produce sold and of that supplied to the school amounted to no less than 21*l.* 7*s.* 5*d.* per acre —a result which is surpassed only by the Feltham Industrial School. I can testify from personal knowledge that the most is made of the circumstances under which the school is placed, and to show how the head-master (Mr. Bowden) keeps abreast of the times, it is sufficient to remark that a silo has been two seasons in operation.

In conjunction with this high agricultural result, the Report by Colonel Inglis, on the educational state in 1884, is worth quoting verbatim:—"In few schools are greater pains taken with the boys than in this, and the results were very satisfactory. The boys entered into the spirit of the place and exerted themselves to do justice to their instructors: 10 in Seventh Standard; a very superior set of boys, well instructed and informed, and intelligent enough for any position: 12 in Sixth Standard; a well-instructed class, and of superior intelligence to that generally met with: 17 in Fifth Standard; very fair results; a few failures in dictation and arithmetic: 27 in Fourth Standard; an intelligent class, a few failures, 8 rather weak in arithmetic: 10 in Third Standard, and 10 in Standard Two; all promising well and pushing on. A fine intelligent school. Good proficiency. Much interest in the work carried on and excellent order." To this I may add that I have looked through the agricultural note-books of some of the boys, and have been surprised at the intelligence and knowledge which their contents displayed; and it is gratifying to add that Mr. Bowden feels that he and his most advanced pupils are strong enough for the commencement of a system of preparation for the South Kensington Examinations in the Principles of Agriculture.

II.—Kent County Industrial School for Boys, Kingsnorth, near Ashford.

"An area of 80 acres of land was purchased by the county specially for the School in 1874. The school uses 73 and 7 are let. Accommodation is provided for 200 boys. The average number for the year 1884 was 178. A few cases are admitted at 8 and 9 years of age, but 10 is quite young enough; the boys leave from 14 to 16. Their future careers are very various. The army and navy certainly hold out the most inducements. We have sent 74 out of 154; as many as 12 have gone after trying other occupations, The boys are employed in working 73 acres, nearly all by hand labour. and in cultivating fruit and all kinds of vegetables required for the use of the establishment. The surplus is sold. No separate payment, excepting the case of 14 boys, who have the care of horses and cows, and then it is 6*d.* per month extra to the mark system prevailing in the school—which carries about 6 marks a day—and every 12 earns a 1*d.* There are 38 acres of permanent grass; 15 acres of arable, chiefly wheat and tares; 16 acres of garden, and the buildings, yards, and playground occupy about 4 acres. No rent is paid for the land; but 3 acres of hop land and 3½ meadow are let for 9*l.*, and a cottage and ½ acre of orchard and garden for 15*l.* The only payments for labour charged to the farm are the wages of a bailiff and two labourers; the remainder is charged to the House Staff. We grow more potatoes than usual in this part of Kent, as they are required and profitable; and also green crops—early food (tares, &c.)—for cows. The live-stock consists of 2 cart-horses, 1 donkey, 13 cows, about 30 pigs, 60 fowls, and 4 store geese.

"The receipts for farm-produce in 1884 and 1885 were as follows:—

	1884. £	s.	d.		1885. £	s.	d.
Vegetables	27	12	3	....	61	11	5
Butter	1	19	4	....	17	15	2
Eggs and Poultry	11	18	3	....	18	5	10
Live Stock	81	5	0	....	35	7	0
Provisions	1	19	9	....	15	1	3
Pork	2	10	0	....	....		
Keep of Sheep	7	4	0	....	13	4	0
Oats and Clover	18	13	0	....	5	0	0
	£153	1	7	....	£166	4	8
Sold to the School:—							
Milk	312	8	0	.....	329	18	9
Butter	27	6	0	....	78	12	4
Vegetables	167	6	2	....	140	4	2
Eggs and Poultry	9	3	6	....	8	12	6
Pork	42	19	4	....	50	13	6
	559	3	0	....	608	1	3
Total	£712	4	7	....	£774	5	11

"The prices obtained are:—Milk, 1*s.* per gallon; butter, 1*s.* 6*d.* per lb.; pork, 7*d.* per lb.; vegetables, market price. The farm-buildings consist of lodges and yards, which are built by the carpenter and boys as required. Agricultural work is excellent for the development of the system physically; only one boy has been rejected for the army, although we admit from the crowded courts and alleys of Deptford, Greenwich, and Woolwich, and other towns in the county. With regard to the future of the boys, farm work is useful, principally in view of emigration, for which these boys are eminently fitted. The passage money stops the greater number. A few boys work

outside the school in the nursery grounds of the Haberdashers' Company, who have estates in this part of the county.

"Elementary education does not suffer at all in such schools as this by its combination with practical work. On the contrary, there is a greater development of latent faculties. The rising generation require *work* according to ability.

"JAMES DUKE,
"Superintendent,
"*Kent County Industrial School for Boys, Mill Bank, Ashford, Kent.*"

The school stands on the summit of a hill; and is entirely unprotected from the force of any wind that may happen to blow; the soil is a poor clay, and under the circumstances has but one recommendation, viz. that it affords ample means for the physical exercise of the boys. The land is kept very clean, and every endeavour is made to turn it to the best advantage. Strawberries are grown with success, and raspberries are being tried. Black currants were not found profitable. One difficulty has been to find a market sufficiently near at hand for what may be termed "fancy" products; therefore the question of the most profitable means of using the boys' labour has been very difficult of solution. The milk of the 13 cows is chiefly used in the establishment, either as milk or butter, but a small surplus is sold. The boys buy milk in addition to the quantity allowed to them. The cow-stalls were a model of cleanliness, and reminded me of North Holland. The education of the boys suffers, according to the Inspector, from insufficient teaching power.

III.—Bolton and County of Lancaster Certified Industrial School.

"Boys are admitted under the Industrial Schools Act, 1866, and also under the Elementary Education Act, 1876. The average number maintained during 1884 was 189·6. The ages vary from 6 years to 13. Average age on admission during the last 8 years has been 10½. Average age on discharge during the same period was 14½ years. The boys are chiefly those who through their surroundings are liable to fall into crime. Many have been charged with offences punishable with imprisonment, but, the charges being waived, they have been ordered by the magistrates to be detained in an Industrial School. From 80 to 90 per cent. of the lads turn out satisfactorily, and settle down to honest industrious habits.

"About a dozen boys are constantly employed on the farm, in tending the cattle, horses, and pigs; in working the land; and in draining, fencing, digging, and cultivating it. The land attached to the school is poor, and is brought under spade-cultivation for the purpose of improving its quality, and of laying it down with a better root, in small quantities at a time. The farming operations here are never undertaken as a *recreation*, but because they afford healthy and invigorating employment, and for instruction in a useful branch of industry, as well as to supply milk and vegetables to the Institution. The *reward* scheme established in the school applies to all the industries carried

on in the school. It consists in apportioning a number of marks per day for each boy *for work done*, according to the quality and quantity of it. These marks bear a money-value. This money is given to the boys on leaving under certain conditions and restrictions. Boys are *fined* from this money for various acts of misconduct.

"There are 21 acres of permanent grass, and 1½ acres of arable land, and ½ acre of garden. The school owns the freehold of 11 acres, and rents the rest (permanent grass) at 20*l*. a-year. The only payment for labour is 1*l*. per week to the bailiff, with house, coal, gas, and water free, equal to about 26*s*. per week.

"The greater part of the land attached to this Institution is permanent pasture, and affords no scope for rotation of crops, except on a very limited scale. When we do crop, the first crop is generally potatoes, next cabbage or other vegetable, and the land is then laid down with a crop of oats, with seed-grass and clover, &c. The live-stock consists of 2 horses, 9 milch cows, 7 pigs (last year), and 25 hens.

		£	*s*.	*d*.
"The live-stock sold off the farm in 1884 realised		102	13	0
Milk and butter		2	2	10
Consumed on the premises.	Milk and butter	237	7	5
	Vegetables	12	11	9
	Eggs	5	10	9
	Total	£360	5	9

"Milk is charged for at 3*d*. per quart; butter at 1*s*. 6*d*. per lb.; and potatoes, from 4*s*. to 7*s*. per 252 lbs. The value of the live-stock varies from 18*l*. to 21*l*. per head (fat). The farm-buildings consist of a barn, stable for 3 horses, cow-byre for 9 cows, piggeries for 10 pigs or more, loose-box, root-house, cart-shed, and shed for steaming provender for cattle and horses.

"The opinion of the Superintendent of this School is decidedly favourable to agricultural occupation for the class of boys dealt with, both as a healthy, invigorating physical exercise, and also as tending to the development of a higher intellectual and moral status. The tending and feeding of horses and cattle in their stalls and byres teaches them humanity, economy, and order, while it diverts their vitiated minds into a new channel, and supplies them with new thoughts and ideas, which exercise a beneficial influence upon their characters. As a means of technical instruction it is also valuable, both for the Home and Colonial labour markets. Many of these lads are fitted only for agricultural labour, while most of them would succeed better if removed from town influences. A training in agricultural occupations fits them for emigration, which is by far the most suitable way of disposing of them. Agricultural labour also acts as a safety-valve, and enables their superfluous energies to find a harmless evaporation.

"W. Nicholson, Hon. Sec.

"Apart from the extra or specific subjects of the Education Code, these lads will compare favourably with the children of any Board School; and we believe that they do not suffer in their education by the combination of school work and industrial labour. On the contrary, it seems to develop their faculties and smarten their intellects. The extent of their education is, reading, writing, and arithmetic, with history and geography, and elementary drawing under the Science and Art Department.

"The examinations held by H.M. Inspector annually are on the same lines exactly as in the Board and other Elementary Schools."

"Richard Gorst, Gov.,
"*Bolton and County of Lancaster Certified Industrial Schools, Lostock Junction, near Bolton.*"

So large a proportion of the land attached to this school being in permanent grass, there is no necessity for any comments of mine in addition to the clear and exhaustive statement given above. Mr. Gorst, the Governor, thinks that more might be done in agricultural training if the Government increased the grant to Industrial Schools, which is much smaller than that to Reformatories. Only three hours a day are given to school work, and yet, in 1884, H.M. Inspector found the education "well attended to," 19 boys being in the Sixth Standard; "superior work:" 23 in Standard Five, 49 in Standard Four, 25 in Standard Three, 23 in Standard Two, and 14 in the First Standard: 43 of the boys had passed the examination of the Science and Art Department in school drawing.

IV.—Leicester School Board Certified Industrial School.

"There are about 190 boys in the school, which is certified for 200; they are generally between 10 and 13 years of age on entering the school, and between 15 and 16 on leaving. About one-third of the boys work regularly upon the land. No special payment or remuneration is made to them. There are about 80 plots of 8 or 10 square yards each laid out as flower-gardens, and any boy who desires can have one of these. Many of the boys take a great interest in their gardens.

"In 1881 the Board purchased 60 acres of land, about 12 miles from Leicester. Fifty-five acres of this was thoroughly worn-out arable land, the rest poor pasture. Twenty-two acres of this land has been laid out as a market garden with standard trees (mostly apple) planted in lines 24 feet every way, with lines of small fruit-trees underneath, leaving flats between for the cultivation of vegetables, &c. A large sum has been spent in making roads, in draining, and in thoroughly manuring the land, which has now been transformed into a fruitful garden. The trees are growing well, and already bear some fruit.

"The remainder of the land is laying itself down into a natural pasture, being assisted by cake and corn given to the live-stock, and by the contents of the closets and urine from the dormitories, which are daily carried and spread upon the fields. In a few years there will be a productive pasture without the cost of cleaning or seeding down. The closets are fitted with metal pans, and are disinfected by using a mixture of gypsum and superphosphate, which of course add much to the fertilizing value of the manure. The cultivation is partly done by horses and partly by the boys—all weeding, pea-getting, &c., by the boys.

"The Committee have taken about 24 acres of land from adjoining owners at from 18*s.* to 20*s.* an acre, and could have any quantity of land at similar prices; but on this they can get no security, so that it is only farmed from year to year, and the outlay is strictly limited to what is likely to be the annual return.

"The land is all on the New Red Sandstone formation; but it is covered in some places by several feet of drift and boulder clay, so that it varies very much in its working.*

---

* The history of the land attached to this school has been drawn up by the Chairman of the Committee of Management, Mr. James Ellis, M.P.

"No payments are made to the inmates; but labourers cost 1*l.* a week, and the bailiff 75*l.* a-year and cottage and garden. The live-stock consists of 4 horses, 15 cows, 30 sheep, and 6 pigs. About 10*l.* worth of cut flowers were also sold last year.

"The produce in 1884 and 1885 was thus disposed of:—

	1884.				1885.		
	£	s.	d.		£	s.	d.
Sold live-stock	190	5	11	....	213	10	9
„ farm produce	310	17	2	....	367	4	11
„ milk, butter, &c.	93	19	3	....	110	6	4
Supplied to the school:—							
Meat	4	5	4	....	....		
Vegetables	61	9	10	....	71	10	5
Milk, butter, &c.	298	13	7	....	390	18	6
Total	£959	11	1	....	£1153	10	11

"There was a profit of 76*l.* 1*s.* 5*d.* on the farm for the year 1885.

"The stables, cow-sheds, tool-sheds, barn, &c., are all well suited for the purposes for which they were intended. The farm is a source of good health and cheerfulness to the boys, especially in the summer, as there is plenty of room in the fields for play. The boys get robust by working on the land, and later on in life may revive their love of gardening. The dairy operations are limited, as most of the milk is given to the boys. Two or three boys help the dairywoman on churning days, about 30 or 40 lbs. of butter being made per week. About 6 boys help in milking. The boys in the Industrial School are much below the average of boys in the ordinary elementary schools, both in intellect and character. To such boys as we have, the work is an undoubted benefit. We believe all boys would be better for industrial training joined with their school work, provided they remained at school until 14 years of age. It is difficult to speak as to the technical value of the instruction given on the farm. Many of the boys return to town life, and London boys, especially, will not stay in the country. It is thought, however, that to teach the boys the use of any tools and to inculcate habits of steady work is a useful result, whether the boys go to farming or not on leaving the school.

"A. H. Burgess,
"Clerk of the Leicester School Board,
"*Leicester School Board Certified Industrial School, Desford, Leicester.*"

In addition to the account just given I may say that the market garden already seems to be doing exceedingly well, and is producing good quantities of fruit, vegetables, and flowers. The soil is not deep, but liberal manuring and constant cultivation, aided by thorough draining, have already done wonders. Since the first great expenditure on what may be termed "reclamation," the outgoings on the garden have become gradually less, and the incomings gradually more. Leicester is nearly 8 miles off, and provides the school with an excellent market for garden produce. Scarlet runners and peas sell most rapidly, but French beans cannot be disposed of, and Bedfordshire beats them in onions. In 1885, two tons of strawberries were picked, and three-fourths of this quantity were gathered carefully and directly into punnets and sent at

once to the Leicester market. The remaining 10 cwt. were made into jam for the use of the school. As a rule, about 30 boys are employed in the garden every morning as half timers, and another 30 similarly every afternoon; but for about a month in the summer school-work is abandoned, and all the boys are employed on the land. This school is under the Leicester School Board, the majority of whose members have succeeded in starving the agricultural part of the establishment, so that the farm-buildings, being constructed of old sleepers, present a great contrast to the substantial school-house and its appurtenances. H.M. Inspector visited the school in 1884 just after the month's holiday from school work, and so found the boys rather out of practice. Still, there were 15 in Standard Six, 24 in Standard Five, 50 in Standard Four, 47 in Standard Three, 32 in Standard Two, and 22 in Standard One.

V.—Middlesex Industrial School, Feltham, Middlesex.

"An average of 760 boys are maintained. No boy is received under 10 years of age, nor retained after 16 years of age. These are boys sent under the provisions of the Acts of Parliament * as being either vagabond or entering upon a vicious career. When they leave they become, as a rule, agriculturists, soldiers, or sailors. A boy on first admission is always placed in a field squad, and employed at digging; this both inculcates industry, and is a good physical exercise. When farther advanced (if he is to become an agriculturist), he is placed on the farm under the bailiff. Rewards are given in the form of good-conduct badges, which carry various privileges. Plots of garden are not given to individuals.

"The farm consists of 9 acres of permanent grass for hay and stock grazing, and 9 acres of rye-grass to cut green for stall-fed cattle, 84 acres of arable land for corn, potatoes, and wurzel, and 5 acres of kitchen garden. Of the whole, 43 acres are leasehold, at 4*l.* per acre, and the rest freehold. The wages of ordinary labourers and also of bailiff amounted to 459*l.* 15*s.* 4*d.* in the year 1884. Boys plant, hoe, set out, and gather in all the crops on the farm, milk and tend cows, horses, &c., under the charge of men. A rotation of crops is arranged so as to leave a produce as varied as possible for the instruction of the boys. The live-stock consists of 4 horses, 23 cows, 14 young stock, and 1 bull; 80 pigs are bred every year, and 100 poultry.

"The buildings consist of a bailiff's house, stable for 6 horses, good cow-house, piggeries, detached cow-house for sick cows, poultry-house, cart-shed, &c., all well adapted to the requirements of the school.

"Nothing is so conducive to the physical and moral development of a boy as agricultural labour, when combined with a limited amount of school instruction, *on the "half-time" system.* The great mass of disorderly and vicious lads come from cities. Their removal to schools in the country, where agriculture is used as a means of industrial training, fits them for following an honest career either as colonists or labourers if removed well away from their former haunts and associates, thus converting them into useful members of the community. In our dairy the boys learn to churn; they are also taught to milk, and generally to look after the cows.

* (1) 17 & 18 Vict. cap. 169; (2) 29 & 30 Vict. cap. 118.

Farm Accounts for the Year ending 31st December, 1884.*

Receipts.

1884. Dec. 31.	£	s.	d.	£	s.	d.
Sales—Wheat, Barley, and Oats	441	4	0			
Milk, Butter, Cream, &c.	234	18	0			
Vegetables (Potatoes, &c.)	49	7	3			
Live Stock	63	8	0			
Sundries	5	1	0			
				793	18	3
Supplies to School—						
Meat	298	10	2			
Vegetables	275	14	5			
Milk, Butter, Poultry, Eggs	1,003	10	3			
				1,577	14	10
Straw for Boys' Bedding				36	0	0
Stock in hand, 31st Dec. 1884—						
Live Stock	817	17	6			
Wheat, Barley, and Oats	221	4	6			
Hay, Straw, and Seeds ..	203	15	10			
Potatoes, Carrots, &c. ..	135	3	8			
Implements and Tools ..	199	2	0			
Wurzel and Manure ..	90	0	0			
				1,667	3	6
Bills owing to the Institution, 31st Dec. 1884				48	1	0
				£4,122	17	7

Payments.

1884. Dec. 31.	£	s.	d.	£	s.	d.
Wages—Bailiff and Labourers ..	459	15	4			
Tools and Implements	39	16	10			
Seeds and Plants	86	10	7			
Manure	..					
Live Stock	45	6	0			
Horse and Cattle Food	539	0	5			
Rent of additional Land (43½ acres at 4*l.*)	174	0	0			
Rates, Taxes, Insurance	55	12	9			
Repairs	89	7	2			
Sundries	96	8	8			
				1,585	17	9
Estimated Rent of own Land (70 acres at 2*l.* per acre)				140	0	0
Stock in hand, 31st Dec. 1883—						
Live Stock	829	0	0			
Wheat, Barley, Oats, &c.	352	16	0			
Hay, Seeds, &c.	214	7	0			
Potatoes	100	8	0			
Implements and Tools ..	247	15	0			
Wurzel and Manure ..	85	0	0			
				1,829	6	0
Bills owing to the Institution, 31st Dec. 1883				79	3	3
Profit				488	10	7
				£4,122	17	7

Robert Bowins, *Storekeeper.*

J. ROWLAND BROOKES, *Superintendent.*

* This statement of account is given to show the details of the large amount of money-yield per acre, viz. 22*l.* 10*s.* It is also an example of those which have furnished some of the materials for my Tables and remarks on the results of spade-labour (see pp. 228–234). The Balance-sheets of all Certified Reformatory and Industrial Schools are constructed upon the same plan.

"With reference to the education of children who will afterwards have to maintain themselves by manual labour, it is of the first consequence that they should be taught to use their hands as well as their heads at an early age, or else they will acquire a dislike to physical labour, which will render it difficult for them afterwards to acquire it.

"I also believe that the syllabus of elementary education will quite admit of a combination of mental and technical instruction without in any way impeding the scholar from passing through a standard of education each year, at all events that is found to be the case in this institution, where only a portion of time daily is given to mental instruction. Possibly up to 12 years of age children might be on the whole-time system, but between 12 and 14, the application of the "half-time" system would tend to prepare them far better for a useful career in life by accustoming them to manual labour.

"J. Rowland Brookes,
"Superintendent,
"*Middlesex Industrial School, Feltham.*"

This school is on such a very large scale, and includes so great a variety of industrial training in combination with general education, that it is impossible to give any correct idea of it without exceeding the limits of this Report. As, however, the money value of the produce of the land (22*l.* 10*s.* per acre in 1884) exceeds that obtained at any Reformatory or Industrial School with which I am acquainted I have preferred to give the statement of Farm Accounts for 1884 *in extenso.* Of course it will be borne in mind that Feltham is not only within a short distance of London, but that it is on the threshold of some important suburbs, which are generally quite as good markets as the Metropolis itself. Captain Brookes has assured me that the physical and mental debility and the appalling ignorance of many of the London boys sent to this school are something incredible to an outsider. The first thing to be done is to strengthen their muscles and give a tone to their system by out-of-door work. This having been accomplished, the future industrial training of the children is settled after due consideration. Notwithstanding this initial difficulty, the education in 1884 is reported upon as "solid and individual, and well attended to in each class," and the Inspector "had very good reason for satisfaction." Having to do with so many London "Street Arabs" and lads of worse character, Captain Brookes may be congratulated upon his success, but it is doubtless owing to the fact, which the Inspector records, that "the organization of the establishment is very complete."

VI.—Stafford County Certified Industrial School, Werrington, Stoke-on-Trent.

"The average number of boys is 112. We do not admit them under 10 years of age, and they are sent until 16 years of age. In many cases

boys leave the school on licence some months before their sentences expire. Our boys work under the half-time system, viz., the school is divided into two sections, one section is at work half the day, the other section in school, and *vice versâ*. We have a mark system and a system of rewards. Nearly all boys are able to earn a small amount as rewards. The farm consists of about 35 acres of permanent grass, and about 10 acres of arable land, including about an acre for kitchen-garden purposes. The county has recently concluded the purchase of this land. From 6*s.* to 8*s.* per month is paid to the boys working on the farm, *i.e.* that amount is about the average (total) divided. One labourer is paid 1*l.* per week, and a man and his wife to look after cattle, dairy, &c., are paid 27*s.* per week. About 4 or 5 acres of oats are grown every year, the remainder of the arable land being potatoes, swedes, carrots, &c. The carrots our boys wash and bunch, and we send them to Hanley Market, finding a ready sale. There are 2 horses on the farm, 5 cows, 2 stirks, 2 calves, 10 pigs, and 16 couple fowls.

"The live-stock sold in 1884 realised 56*l.* 3*s.*; that supplied to the school, 39*l.* 14*s.*; butter, 36*l.* 9*s.*, sold; supplied, 22*l.* 0*s.* 4*d.*; milk supplied, 27*l.* 5*s.* 4*d.*; vegetables sold, 81*l.* 6*s.* 3*d.*; supplied, 59*l.* 5*s.*; making a total of 322*l.* 2*s.* 11*d.* for farm produce, in addition to herbage for other departments charged, 75*l.* 13*s.* The farm-buildings are built of stone; they are small, but suitable and convenient.

"Nearly all the boys on admission are put to farm and garden work before being put to trades, &c. The outside work is better for health, gives a good appetite, has a wholesome effect on mind and body, and hardens the constitution. Some of the boys take to farm-work on leaving the school. Our land is very cold and poor; I suppose we are in about the bleakest part of the county, consequently *very late* with crops.

"As far as my experience goes, I do not think elementary education suffers at all by its combination with practical work. On the other hand, I think it has just the opposite effect. Working as we do under the half-time system, I do not hesitate to say that we compare most favourably in our results with the Board Schools in the district.

"Benjamin Horth,
"Superintendent,
"*Staffordshire Certified Industrial School, Werrington, Stoke-on-Trent.*"

Every arrangement of this school is kept in a high state of efficiency, but from an agricultural point of view its position is as undesirable as can well be imagined. Soil, situation, and climate are all against a good agricultural return. A moory soil upon a clay subsoil, in a high and exposed situation, between five and six miles from a railway station, may be a combination of advantages from a Reformatory point of view, but not otherwise. Still, the most is made of possibilities, although the peaty soil, notwithstanding dressings of lime, continues to produce club in the cabbage and its allies, finger-and-toe in turnips, and to make it almost impossible to grow onions. Carrots are found to be the most paying crop, as they suit the soil and climate, and find a ready sale at Stoke and Hanley. They are pulled, washed, and bunched at the school one or two days before they are sent to market in charge of a member of the staff and a couple of the boys. Sold retail by

the bunch on the market-place, they bring in an excellent return. This kind of experience is in itself an important item in the industrial education of the most trustworthy boys. As to education, 18 were in the Fifth Standard in 1884, 24 in the Fourth, 29 in the Third, 27 in the Second, and 15 in the First. It should be added that H.M. Inspector has recorded his opinion that this school "could well be expanded so as to accommodate 150 [boys] without any drawback to general efficiency."

VII.—Farm School, Bisley, Surrey.

"This school is a voluntary branch of the "National Refuges for Homeless and Destitute Children." The only grant which it receives is from the Education Department. The average number of boys maintained is 150. Boys are admitted between the ages of 8 and 14; being homeless and destitute, or orphans. They leave at the age of 15 or 16. Boys who are strong and willing, and have their friends' (if any) consent, are sent to Canada as farm labourers; others are found situations in London and the country. Fifty boys are employed on the farm and garden as half-timers, but receive no payment or reward for work done. The boys prefer farm-labour to any other employment we can find for them, and we find it to be the most beneficial (physical) training we can give, as the most weakly boys in a few years become quite strong and robust.

"The farm consists of 80 acres of permanent grass, 50 acres of arable land, and 6 acres of garden, the whole being freehold. Weekly payments for labour on the farm and garden are:—Bailiff, 21*s.*; gardener, 23*s.*; five labourers, 4*l.* 4*s.*

"Our farm is managed in the ordinary way. We use no guano, but purchase some stable-manure, nitrate of soda, and salt. The rotation of cropping is wheat, fallow crops, barley, peas, and clover. The live-stock consists of 5 horses, value 200*l.*; 16 cattle, value 256*l.*; 60 pigs, value 120*l.*; 100 poultry and geese, value 15*l.*

"The produce sold in 1884 realised the following amounts:—

	£	*s.*	*d.*
Wheat	135	16	0
Barley	116	11	0
Potatoes	5	6	0
Dairy	115	12	0½
Cattle	66	11	0
Pigs	234	15	5
Poultry and eggs	9	2	6½
Fruit	2	1	5
Timber	69	12	6
Supplied to school	247	13	3
Total	£1003	1	2

"The farm-buildings form a square, with a large farmyard covered with corrugated iron, which we have found of the greatest advantage to the cattle, and protection to the manure. I consider that farm-labour has a most beneficial influence in developing the young mind in the right direction; the greatest difficulty is in getting intelligent labourers to instruct them. We have a class for the study of the "Science of Agriculture" in connection with South Kensington, which we hope will be of use to the lads who follow

farming in Canada and elsewhere. I may say that the lads have taken a great interest in the instruction given.

"I do not believe that elementary education suffers at all in such schools as ours on account of its combination with practical work. My experience is, that the boys employed on the farm (being well fed) can make as great progress in school as those who are not, if not more. The results we have obtained compare favourably with those of Board Schools. Considering the neglected condition of many of our boys when admitted, and the advancement they make (as half-timers) while in the home, I am convinced that practical work is a help rather than a hindrance to elementary education.

"ANGUS MACKAY,
"Superintendent,
"*Farm School, Bisley, Woking Station, Surrey.*"

The distinction between this and the preceding Industrial Schools has been stated above by Mr. Mackay, and requires to be borne in mind. The land is light and the garden very productive. On the arable land a catch-crop of rye is grown after wheat and before turnips or cabbage. The distance of the school from a good market is the greatest drawback to a better financial result of the farming operations. Still, a boarding school in the neighbourhood is supplied with 15 lbs. of butter per week at 1*s.* 6*d.* per lb., the whole year through, and the occupiers of villas without much land attached, both in the immediate vicinity and at Weybridge, purchase hay at remunerative prices. The Superintendent has not been successful in placing boys with English farmers, but a few obtain situations as under-gardeners and under-grooms. The Society has, however, a receiving home at Hamilton, Canada, whence the boys are sent by the Master of the Home, on terms which he arranges for them, to Canadian farmers as apprentices for twelve months, after which the boys can generally make their own terms. These boys are so much in request that the Superintendent of the school generally has applications for three times as many as he can send out. The education given here is of a much higher stamp than I found at any other school which I visited, with the single exception of the Boys' Farm Home at East Barnet; and it is interesting to observe that at both these schools a beginning has been made to teach the principles of agriculture under the South Kensington rules. As the educational condition of the boys is certified annually by an Inspector of the Education Department, I am unable to give statistical details; but I would add, from personal observation, that, considering the majority of the boys before their admission into this school were systematically in the habit of evading the Board Schools and their officers, the results which have been achieved appear very remarkable.

VIII.—Sheffield School Board Truants' Industrial School.

"The average number of boys is 85; their ages vary from 7 to 13. The average time of detention is 14 weeks, when a ticket-of-leave is granted to live out of the school on certain conditions, viz. regular attendance at a specified elementary school. Their past history is:—Neglected by parents, or bordering on the age when the boy, thinking to be free from school, seeks to work, or to declare himself a *man* by having his own way. Or, being dull and not finding himself able to keep up with his brighter companions, neglects his work, and absents himself from school to evade the punishment of his neglect and want of capacity. The boys (the greater number) are employed on the farm in one capacity or other during half the working day. There is no scheme of payments, as the short detention (in some cases only 6 weeks) prevents such being carried out. At first, plots of garden ground were given to the children; but the frequent changes operated against this system. Many disputes arose as to the ownership, and when that was settled, I found that each boy wanted a garden after his own plan, and that therefore the previous work of a former boy was lost.

"The farm includes 118 acres of permanent grass, a great portion of which is rough or moorland, also 20 acres of arable land, and 6 acres of garden. The rent is 10*s.* per acre all over. Much of the land has been drained, and part of the rough land reclaimed; 8 acres are this year under spade-cultivation. The payments for labour include that for special help at special times, the rate of wages being according to the season; wages of the gardener, 13*s.* 6*d.* per week and board and lodging; farmer and wife, 15*s.* 5*d.*, with several perquisites; and horseman, 16*l.* per year, with board and lodging. Green crops are grown for cows, also oats and grass, together with a few acres of potatoes. The live-stock consists of 5 horses and ponies, 20 milch cows, 14 young cattle, 19 sheep, 21 lambs, 14 pigs, and 20 couples of poultry.

"The sales during the year ended September 29, 1885, were:—

	£	*s.*	*d.*
Milk, butter, &c...	461	3	2
Vegetables ..	38	14	1
Live-stock ..	268	16	9
Sundries ..	6	4	3
	£774	18	3
Supplies to school ..	224	17	10
Total ..	£999	16	1

The buildings are old, and totally unsuitable for cattle.

"We have a dairy, but no instruction is given beyond milking and the care and feeding of the animals. Boys who, through unforeseen circumstances, have been kept for a considerable time at the school, have been enabled by our instruction to fill situations as farm lads with the neighbouring farmers.

"I think there can be no question as to the adaptability of farm-labour as a means of influencing the mind in a right direction. First, it is calculated to keep the body healthy, and we find evil in its most malignant forms where masses are congregated together, hence farm-labour for our schools means keeping the lads from the haunts of evil; and intelligently taught, and with the training which the schools afford, we have every reason to hope that to look from Nature up to Nature's God will be the result of such labour. If help were given in some practical form, our Reformatory and Industrial schools would be the very best to impart a technical agricultural education.

"I should think that elementary education does not suffer at all by its combination with practical work.

"ISAAC McHARDY,
"Superintendent,
"*Sheffield Truants' Industrial School, Sheffield.*"

This school is of yet another stamp; but its management illustrates how practical work can assist the education of boys who have hitherto been incorrigible truants, although the term of their detention does not average more than fourteen weeks. The land is in a very exposed and high position, and has been reclaimed from the moor. Bush fruits, rhubarb, and strawberries are much grown, but the climate is too late to make market-gardening profitable. Milk is sold by contract to a milkman in Sheffield; and at the time of my visit (June, 1885) butter was being sold at 1*s.* 3*d.* per lb. This was considered a very low price, but at the same time the general market price in Sheffield was only 11*d.* The peculiar circumstances of this school render it probable that the School Board will not retain the farm much longer, but will keep only 10 or 12 acres for kitchen-garden and other purposes. Further, also, owing to the short period of detention of the boys, nothing can be said with regard to their general education beyond what has been already stated by Mr. McHardy.

CONCLUSION.

The details given in the preceding pages refer only to 18 out of 61 Reformatory Schools, and to 8 out of 145 Industrial and Truant Schools; but all those which I have visited are Boys' Schools, in which agricultural training holds at least a conspicuous place. At the Reformatories, the total number of inmates in 1884 was 6360, and the number in the Industrial Schools was 19,483; while the total expenditure in the former case was 125,583*l.*, and in the latter, 362,614*l.* This money was found partly by the Treasury, partly by the ratepayers, and partly by the subscribers, while the parents were made to repay the Treasury a fraction of the amount advanced. The following tabular statement will make this part of the subject clear:—

	Reformatories.	Industrial Schools.
Number of boys and girls	6,360	19,483
	£	£
Paid by Treasury	85,528	183,458
Repaid by Parents	6,168	17,955
Paid out of Rates	24,917	39,466
Paid by School Boards	..	78,193
Subscriptions	4,146	30,152
Profits and Hire of Labour	11,436	25,204
Total Expenditure	125,583	362,614

It will thus be seen that the cost of board, lodging, tuition, and clothing, does not differ materially per head in the two classes of schools, but that the Government pays a larger proportion of it in the case of the Reformatories. In 1884 the average cost for English Reformatory boys was 19*l.* 16*s.* 5*d.* each, and for Industrial boys 18*l.* 6*s.* 8*d.*; but whereas the Treasury allowance in the former case is generally 6*s.* per week, in the latter it does not exceed 3*s.* 6*d.*, and in some cases is only 2*s.* The payments made by counties and boroughs vary very much—generally from 1*s.* to 2*s.* 6*d.* per week—according to whether the inmate belongs to the county in which the school is situated, or comes from a "foreign" county. Naturally, also, the local contributions are to some extent regulated by the financial position of the school. In any case, however, an average sum approaching 20*l.* a year must be provided for each boy, and only about 5 per cent. of it is contributed by the parents. This public expenditure is no doubt necessary in the interests of society, in order to avoid greater evils and greater expense in the future; but at first sight it certainly seems an encouragement to parents of a certain class to allow their children to acquire criminal habits. The results of the expenditure from the Reformatory point of view are sufficiently encouraging, as about 79 per cent. of the boys and 72 per cent. of the girls hitherto discharged from Reformatories, and about 81 per cent. of both sexes discharged from Industrial Schools, are known to have done well for some years afterwards. It will have been noticed that the average age of the boys at Industrial Schools is less than that of those committed to Reformatories; and further, that the former are not so ignorant as the latter (except in criminal acquirements) at the time of their admission to the school.

The educational enquiry has brought out an immense preponderance of opinion in favour of the combination of agricultural training with elementary education. In our higher grade schools a considerable portion of each day is devoted to physical training of some kind; and in Reformatory and Industrial Schools the same result is aimed at, and is obtained, by devoting the muscular exercise to a technical purpose. Of course it does not follow that the book-work in rural elementary schools should be restricted to three hours a day, as it is in Reformatories; but I am quite sure that the principle of the half-time system, which Mr. Chadwick and others have advocated for more than a quarter of a century, is the right one, and its success with comparatively young children in the Industrial Schools described is very striking. By the adoption of such a system in rural elementary schools, boys and girls would learn to use their heads and their hands in combination,

and thus to discharge their duties intelligently instead of mechanically. For purposes of instruction at a rural elementary school it would not be necessary to have so large an acreage of land as is attached to Reformatory Schools as a means of employment of the inmates, nor would it be desirable to adopt the expensive system of spade-labour, except on a small acreage of garden-land.

I have always given little heed to mere theoretical statements put forward without reference to the facts or experience upon which they are based, and therefore I have devoted many pages of this Report to the actual record of facts and experiences with which I have been furnished by the authorities of Reformatory and Industrial Schools. Some persons may say that I have called too many witnesses; but if I had discharged my duty in a less complete manner, others would have complained that the evidence brought forward was not sufficient to establish the case. I quite admit that the *onus probandi* lies with those who desire a change from the established order of things, and although I consider that I have brought forward more evidence than is sufficient to establish my view, I have thought it right to call one other witness to defend what some might still consider to be a weak point in my armour.

It has occurred to me that the objection might be made that farmers in many districts would not agree to the adoption of the "half-time system" by employing "half-timers" for farm-work, either during half-days or upon alternate days, on account of the necessary break in the continuity of work which such a system would necessitate. I therefore have selected the following extracts from a letter on the subject, which was addressed to Mr. Barwick Baker in 1872. The writer is the Rev. E. Lowbridge Baker, and he stated as follows:—

"We made the following suggestion to the farmers, that if they would agree to employ *no boys under ten years of age*, and none *between the ages of* 10 *and* 14 *except those who attended school*, we would find suitable boys for their work; they should state to the schoolmaster the work to be performed, when two would be chosen from a list of eligible boys, each of whom should work on alternate days, and when not at work he would be at school.

"The farmers could not see it at first, and raised several objections, more particularly the trouble of teaching two boys the work to be done instead of one. However, I suggested that they should give the scheme a trial, and if they did not like it, and it did not work well, that it must be given up. All the farmers in the parish agreed to make the experiment, and consequently our school was at once filled with children. I fully expected at first to hear complaints from the parents that they could not afford to send their children to school, but nothing of the sort—they were very much pleased with the regulation; as they said, 'it gave all a chance;' they looked at it in the light of a compromise, getting schooling for their children, and at the same time earning a small amount of wages.

"After the plan had been working some nine or ten months I asked

whether the farmers liked it or otherwise, and I was told they were perfectly satisfied, and as a reason for liking it, they said the boys did their work better by working only on alternate days, and that if there were any cause of complaint they held a threat over the boy that the schoolmaster would be told of it. If the work is not satisfactorily performed, a fresh choice is made from the list of boys who are willing to work; but this is very rare. The wages are generally paid to the master of the school, who transfers them to the boys or their parents.

"This is a rough sketch of the plan, and I can say that the attendance at this school is about the highest in the district as regards regularity and number of days. Facts will speak for themselves. The population of the parish is 430; the average attendance at school last year was 91; the number of children presented for Government inspection was 81; and the grant from the Committee of Council on Education amounted to 46*l.* 18*s.* 6*d.*"

Other statements corroborative of this clergyman's experience might easily be given, but the above seems to be sufficient for my present purpose.

The agricultural enquiry has shown clearly that many of the schools have been built in localities and upon soils which were unsuitable for profitable spade-farming, and were certain to entail a serious annual deficit in the farm accounts. It is doubtless of great importance to place Reformatory Schools a sufficient distance from large centres of population and in a healthy locality; but after giving due weight to those considerations, and also to the fact that the object of such institutions is the reformation of the inmates, and not the creation of a successful business, it will be seen by the annexed Tables (pp. 230–233) that the money-value of the produce of an acre of land in 1884 varied at different schools from about 3*l.* 12*s.* to 22*l.* 10*s.* Personal inspection enables me to say that this enormous difference is due partly to soil and partly to climate, but chiefly to the relative accessibility of a good market for the produce.

Much has been said and written of late years about the advantages of spade-labour, but I do not know that any definite profit and loss accounts have hitherto been published in support of the idea that it is economical, or that it enables the cultivator to extract a larger produce from the soil than by more mechanical means. Under ordinary circumstances, it is reckoned by Reformatory authorities that the power of an average boy is sufficient for the cultivation of each acre of land; and Table II. bears out this statement as a whole. If we disregard the wages paid to a bailiff or labour-master, as being paid for supervision and not for work, and put the value of a Reformatory boy's services at 1*s.* per diem, for the considerable proportion of the day that he is engaged on the land, on the ground that it is the average amount which neighbouring farmers are willing to pay for his services, it is obvious that the boy's labour-bill

alone will amount to 15*l.* per acre for 300 working days. At Feltham, where 22*l.* 10*s.* per acre is realised for the produce, no fewer than 2½ boys are employed per acre, so, at the above rate, the cost of labour is 15*l.* in excess of the receipts. Against this, we have to put the very large farm profit (exclusive of boys' labour) of 4*l.* 10*s.* per acre, leaving a net deficiency of ten guineas per acre. But even this result is obtained only by so large a proportion as two-thirds of the receipts being for vegetables and dairy produce. At the North-Eastern Reformatory, near Morpeth, we find a large farm of 500 acres, nearly two-thirds of it in grass, and only 85 boys employed on the whole farm, most of the work being done by men, horses, and implements. The gross value of the farm-produce in 1884 was only 3*l.* 12*s.* 2½*d.* per acre (the lowest in the list), and the accounts show a farm loss, exclusive of the cost of boys' labour, of 820*l.* 15*s.* 7*d.*; but if to this we add 1275*l.* for the omitted item, the total loss is less than four guineas per acre, although the value of the produce per acre is relatively so small.

A better illustration than that afforded by either of the above extreme cases is furnished by the Northamptonshire Reformatory, which is in an agricultural district, and the land attached to which is worked entirely by the spade-labour of the inmates. We here escape from the disturbing influences of the plough, of an excess of grass-land, and of an insatiable market; and we have the theoretical number of one boy to each acre of land. The farm accounts show a modest profit of 37*l.* as the result of working 45 acres of land, and the value of the produce per acre reached the respectable amount of 7*l.* 7*s.* 4*d.* in 1884; but although a considerable amount was received for boys' labour from neighbouring farmers, the net result is that the labour applied by the boys to the school land cost 5*l.* 14*s.* 4*d.* per acre more than what was received for the crops produced.

The Bedfordshire Reformatory may be quoted as another typical example in an agricultural district, with the great advantage of high farming, bringing the value of the produce up to 9*l.* 11*s.* 8*d.* per acre. Here there are 50 acres of land worked by 54 boys, so that the boys' wages would amount to 16*l.* 4*s.* per acre, subject to the deductions for the above-mentioned value of the produce and of 2*l.* 2*s.* 2*d.* per acre for the earnings of the boys on neighbouring farms, leaving a net sum of 4*l.* 10*s.* 2*d.* per acre as the excess of boys' wages over the value of the produce.

An examination of the Tables annexed will show that the same fact is common, in a greater or less degree, to all the schools, as illustrations of the costliness of spade-labour. But the schools are themselves only illustrative of what is known generally of the superior economy of horse-power over man-

TABLE I.—Giving approximately the NUMBER of BOYS, the ACREAGE of LAND,
the BOYS) for certain REFORMATORY and

Number.	Name of School.	Acreage of Arable.	Acreage of Grass.	Acreage of Garden.	Total.	No. of Boys.
					REFORMATORY	
I.	Bedfordshire	40	4½	5½	50	54
II.	Bradwall (Cheshire)	60	55	1	116	62
III.	Devon and Exeter	15½	2½	7	25	30
IV.	Glamorganshire (Neath)	22	19	..	41	50
V.	Hardwicke (Gloucester)	35½	52	..	87½	84
VI.	Kingswood (Gloucester)	..	..	15	15	148
VII.	Herts (Ware)	30	8	1	39	45
VIII.	Liverpool (Newton-le-Willows)	15	5	8	28	135
IX.	North Lancashire (Bleasdale)	20	131	2	153	127
X.	Manchester and Salford	..	..	..	76	74
XI.	Northamptonshire's Society	34	9	2	45	45
XII.	North-eastern (Northumberland)	183	315	2	500	176
XIII.	Thorndon (Eye, Suffolk)	40	17	2	59	80
XIV.	Philanthropic Society (Redhill)	216	64	17	297	300
XV.	Stoke Farm (Worcester)	35	..	35	70	80
XVI.	Castle Howard (Yorkshire)	53	40	2	95	80
XVII.	Leeds (Adel)	5	3	7	15	150
XVIII.	Calder (Mirfield, Yorkshire)	34	80½	5	119½	110
					INDUSTRIAL	
I.	Boys' Farm Home (E. Barnet)	9	36	1	46	87
II.	Kingsnorth (Ashford)	15	38	16	69	178
III.	Bolton and County of Lancaster	1½	21	½	23	190
IV.	Leicester School Board	24	38	22	84	190
V.	Feltham (Middlesex)	84	18	5	107	750
VI.	Werrington (Stoke-on-Trent)	9	35	1	45	112
VII.	Bisley (Surrey)	50	80	6	136	150
VIII.	Sheffield Truant School	20	118	6	144	85

N.B. In the Farm Accounts of some of the Schools the amount received for the hire of
the accounts uniform and more illustrative of my purpose, I have, wherever pos-
not specially to the Farm. In the case of the North-eastern Reformatory this has
departments.

and the FARM PROFIT OR LOSS (without CHARGING anything for the LABOUR of INDUSTRIAL SCHOOLS in the YEAR 1884.

Rent.	Farm Profit.	Farm Loss.	Net Cost of Keeping Boys per Head.	REMARKS.
SCHOOLS.				
£ s. d.	£ s. d.	£ s. d.	£ s. d.	
84 13 10	28 12 1	..	19 10 6	
208 5 0	5 10 3	..	21 10 4	Employment almost exclusively agricultural.
35 10 0	6 4 1½	..	21 8 4	
63 10 0	87 15 10	..	18 4 10	Garden area not given separately.
123 16 11	..	264 10 7½	21 1 1	Do. do. do.
None	..	22 19 5	22 1 2	Only 25 boys employed on the land. Accounts quoted are for 1883.
53 4 0	21 1 11	..	18 12 9	
90 0 0	..	31 3 5	19 12 3	About one-third of the boys are employed on the land.
132 0 0	..	140 14 2	20 18 9	66 acres of the grass-land have been recently added, so the accounts relate to only 87 acres of land of all kinds.
134 11 11	..	21 4 1	21 15 7	Subdivision of land not given. The farm about to be given up.
109 15 10	37 2 1½	..	24 15 0	Accounts quoted are for 1883.
402 0 0	..	820 15 7	21 13 2	The accounts of this school are subdivided, and labour done by one department for another is charged.
81 0 0	65 8 5	..	13 4 7	
91 8 7	240 2 7	..	23 4 0	Rent is charged for only 57½ acres, the remainder being the Society's freehold.
228 12 6	..	28 17 2	15 4 6	
145 10 0	..	202 7 6	21 9 11	
10 6 11	..	137 14 11	20 3 9	
139 10 0	..	256 13 3	20 4 0	
SCHOOLS.				
None	..	58 15 7	19 16 7	
None	161 6 9	..	17 7 11	Also 4 acres of Playground.
39 0 10	32 19 6	..	14 11 0	
?	..	..	22 2 1	Rent 18*s.* to 20*s.* per acre for 24 acres, remainder free.
174 0 0	488 10 7	..	26 10 7	About 270 boys employed in agriculture. Rent charged for only 43½ acres, remainder free.
None	..	..	17 4 2	
None	58 1 11†	..	..	† Inventory not taken into account.
91 7 7	..	265 11 7	20 18 4	

Boys is treated as a Farm Receipt, but in others as a General Receipt; therefore to make sible, treated the Hire of Boys as an item belonging to the General School Account and been impossible, owing to the subdivision of the published Accounts amongst the School

TABLE II.—Showing approximately the VALUE of PRODUCE and ESTIMATED AMOUNT

NAME OF SCHOOL.	Acreage of Land.	Total Produce.			Produce per Acre.			Spade Labour. Approximate No. of Boys employed on the Land.	Spade Labour. Wages at 1s. per Day for 300 Working Days. Total.	Per Acre.		
		£	s.	d.	£	s.	d.		£	£	s.	d.
REFORMATORY												
I. Bedfordshire	50	479	5	5	9	11	8½	54	810	16	4	0
II. Bradwall (Cheshire)	116	717	5	3	6	3	8	62	930	8	0	4½
III. Devon and Exeter	25	198	10	5	7	18	10	30	450	18	0	0
IV. Glamorganshire (Neath) ..	41	400	17	2	9	15	6½	50	750	18	5	10
V. Hardwicke	87½	946	4	9	10	16	3½	84	1260	14	8	0
VI. Kingswood	15	154	14	2	10	6	3½	25	375	25	0	0
VII. Herts (Ware)	39	317	14	1	8	3	0	45	675	17	6	2
VIII. Liverpool (Newton-le-Willows)	28	486	19	8	17	7	10	45	675	24	2	2
IX. North Lancashire (Bleasdale)	87	394	15	1	4	10	9	77	1155	13	10	1
X. Manchester and Salford	76	501	0	4	6	11	10	74	1110	14	12	1
XI. Northamptonshire Society's ..	45	331	10	3	7	7	4	45	675	15	0	0
XII. North-eastern (Northumberland)	500	1805	12	10	3	12	2½	120	1800	3	12	0
XIII. Suffolk	59	410	0	10	6	19	0	80	1200	20	6	9½
XIV. Philanthropic Society (Redhill)	297	2798	6	11	9	8	5½	300	4500	15	3	0
XV. Stoke-farm (Worcester)	70	1092	5	4	15	12	1	80	1200	17	2	10
XVI. Castle Howard	95	442	19	7	4	13	3	80	1200	12	12	7½
XVII. Leeds (Adel)	15	141	16	5	9	9	1	..	..		..	
XVIII. Calder (Mirfield)	119½	628	14	8	5	5	2	80	1200	10	0	0
INDUSTRIAL												
I. Boy's Farm Home	46	983	1	8	21	7	5	87	In these schools only a proportion of the boys are employed on the land.			
II. Kingsnorth (Ashford)	69	712	4	7	10	6	5	178				
III. Bolton and County of Lancaster	23	360	5	9	15	13	3½	190				
IV. Leicester	84	959	11	1	11	8	3	190				
V. Feltham	107	2407	13	1	22	10	0	750				
VI. Werrington (Stoke-on-Trent)	45	397	15	11	8	16	9½	112				
VII. Bisley (Surrey)..	136	1003	1	2	7	7	6	150				
VIII. Sheffield Truant	144	999	16	1	6	18	10	85				

* For gross produce or loss irrespective of charge for Spade-labour, see Table I.

† In this instance the produce exceeds the cost of boys' labour by 2½*d.*, but 63 per cent. of the

of BOYS' WAGES per Acre for certain REFORMATORY SCHOOLS in the YEAR 1884.

Gross Excess of Wages per Acre * over Value of Produce.	Hire of Boys.		Net Excess of Wages per Acre over Value of Produce.	REMARKS.
	Total Amount Received.	Amount Received per Acre.		
SCHOOLS.				
£ s. d.	£ s. d.	£ s. d.	£ s. d.	
6 12 3½	105 8 8	2 2 2	4 10 1½	
1 16 8½	..	..	1 16 8½	Hire of Horses and Sundries, 21*l.* 19*s.* extra. Only about 60 acres under cultivation, remainder in grass.
10 1 2	105 10 7	4 4 5	5 16 9	
8 10 3½	32 2 3	0 15 8	7 14 7½	Hire of Horse to School, 15*l.* extra.
3 11 8½	119 3 8	1 7 3	2 4 5½	
14 13 8½	..	..	14 13 8½	148 in Reformatory, but only 25 employed on the land, which is all garden.
9 3 2	303 6 4	7 15 6½	1 7 7½	
6 14 4	..	..	..	135 in Reformatory, but only one-third employed on the land. Receipts include a certain amount for boys' labour.
8 19 4	62 18 7	0 8 3	8 11 1	66 acres additional recently added.
8 0 3	..	..	..	Farm about to be given up on account of smoke damaging the crops.
7 12 8	86 5 10	1 18 4	5 14 4	Account for 1883.
0 0 2½†	..	..	..	A large acreage (315 acres) is poor grass.
13 7 9½	..	..	..	
5 14 6½	..	..	5 14 6½	
1 10 9	..	..	1 10 9	Received also for sand and gravel 100*l.* 5*s.* About 35 acres garden and orchard.
7 19 4½	133 8 0	1 8 1	6 11 3½	
..	173 7 9	11 11 2	..	70*l.* was also received for hire of horses. About 150 boys in the Reformatory.
4 14 10	288 0 11½	2 8 2½	2 6 7½	About two-thirds of the boys employed on the land.
SCHOOLS.				
..	..	..	..	
..	..	..	..	
..	..	..	..	
..	..	..	..	
..	..	..	..	About 270 boys employed on the land.
..	..	..	..	
..	..	..	..	
..	..	..	..	

land is in grass, and the plough generally takes the place of the spade on the arable land.

power, and of steam-power over horse-power. I venture to quote the following concise statement of the problem from a speech made at the March meeting of the Farmers' Club by my friend Mr. D. Pidgeon: "In his admirable little book on Farm Labour, Mr. J. C. Morton has shown that we have in this country about 1½ million horses, of which 800,000 we employ in agriculture. Now assuming that these horses work for six months out of the twelve continuously, and that, as Mr. Morton shows, each horse does the work of 32 men, it becomes clear that if we were entirely without such implements as are actuated by horses, or in the condition of pre-implement-using man, we should need 32 times 400,000, or some 12,000,000 pairs of hands, to replace the horses now employed in British agriculture. . . . Being presumably without implements of any kind, we should require to spend nearly ten times more than we now do upon agricultural labour in order to raise the same amount of cropping." I need not go into the question of steam-power; it is sufficient to mention that one theoretical horse-power developed by the steam-engine is considered as effective as the power of two actual horses, and is infinitely more economical.

The determination of the agricultural value of spade-cultivation, as compared with the results obtained by means of the plough and the cultivator in otherwise identical circumstances, has never yet been made in a scientific manner, so far as I know. But Mr. G. W. Latham, M.P., asserts (p. 181), as the result of his long experience, that, "as compared with plough-work, we require at least half more manure, and all our crops ripen ten to fourteen days later;" but against this I ought to quote Mr. Sturge's statistics of the crops grown at Stoke Farm, for a series of years, as given on p. 203. It would certainly be most interesting and useful if experiments on this question could be carried out on different soils, and under different climatic conditions. It is scarcely necessary to add that there are some agricultural operations in which the spade is the only possible implement for, at any rate, a portion of the processes. Draining, and reclamation under certain conditions, may be quoted as examples. But these operations come under the head of "Permanent Improvements," and may properly be charged to the Capital account, whereas the ordinary cultivation of the land from year to year must be charged to the Income account; and by spade-labour, as I have shown, it is vastly too expensive to be remunerative.

This part of the subject is, however, quite subsidiary to the main question which I have endeavoured to illustrate, namely, the professional and educational advantage of combining technical instruction with general education in the elementary

schools in our rural districts. Therefore I have not gone into minute calculations and deductions, on account of some of the boys being employed at some of the schools more or less in house-work and in mending clothes. Nor have I thought it necessary to endeavour to estimate the relative amounts of work done by boys and men respectively. The elements of the question are given, and they appear to supply the fundamental data for the solution of some very interesting problems.

With regard to the most profitable means of utilising the boys' labour, having due regard to the situation and circumstances of each school, I would suggest to some of the managers the desirability of devoting more land to the cultivation of industrial (including medicinal) and market-garden crops—the latter where climate, soil, and proximity to a market are favourable, and the former where those conditions are absent. As an example of my meaning, I may say that I have not observed a piece of flax on the farm attached to any school. No doubt the growth of industrial crops, and especially their preparation for market, would necessitate care and attention on the part of the labour-master in directing the older boys; but that simply means additional education of a technical, and therefore of a most valuable, character.

The great difficulty which most of the managers find is the disinclination of English farmers to board lads in farm-houses —certain districts in England and Wales excepted;—but if it were more generally known that excellent workers, well instructed in the means of cultivating the land, and in tending the animals of the farm, could be obtained from these schools, I think that farmers would endeavour to make arrangements with their married labourers to board and lodge such boys, and that we should then hear from them much less than at present about the impossibility of obtaining "a fair day's work for a fair day's pay." Some of these schools already have a steady demand for boys from farmers in the Colonies and in some particular districts of England; and in the case of the East Barnet Farm Home it curiously happens that the demand comes from a limited region in South Wales, because, as I am informed, it has been found that the boys can teach the Welsh farmers' children the English language!

I have frequently been asked, in the course of conversation upon the technical education of the agricultural labourer, "If your scheme were adopted, where would you find teachers competent to carry it out?" My reply has been—"Create the demand, and the supply will follow." Now I submit that the replies to my questions, which are given in the preceding pages, are sufficient to prove that the working heads of the Reformatory and Industrial Schools are a body of highly intelligent

and cultivated gentlemen, and I see no reason to doubt that teachers as capable may be found for our elementary schools as those who have for many years been obtained for Reformatories and Industrial Schools. It would be invidious to make any selection of the replies of these gentlemen for special comment, and therefore I will only add the expression of my grateful thanks to them, and to the members of the governing bodies whom I met during my visits, for the trouble they have all taken in giving me the information that I asked for, and also for their kindness and hospitality when I visited them.

This Report cannot be fitly concluded without a word of acknowledgment to Colonel Inglis, H.M. Inspector of Reformatories and Industrial Schools, and to Mr. Rogers, the Deputy-Inspector. I can imagine it possible that an independent investigation into the condition and mode of working of establishments which are under Government supervision might be looked upon with coldness, if not met with opposition, by the official and responsible Inspectors. But both Colonel Inglis and Mr. Rogers took a very different view of my enquiry, and volunteered to give me every information and assistance in their power. I have largely availed myself of their kindness, and I wish to record my great appreciation of their valuable aid.

VI.—*Report on the Field and Feeding Experiments at Woburn, conducted on behalf of the Royal Agricultural Society of England during the year* 1885. By Dr. J. A. VOELCKER, B.Sc., Consulting Chemist of the Society.

EXPERIMENTS ON THE CONTINUOUS GROWTH OF WHEAT.

THESE experiments were carried on in the same manner as in former years. On August 25th, 1884, the experimental plots were broken up with the grubber to prevent weeds seeding. On October 16th mineral manures were sown on Plots 4, 5, 6, 8 and 9, being harrowed in, and the ground then rolled. On the 21st, 22nd, and 23rd, Browick wheat was dibbled in at the rate of 9 pecks per acre, and the land harrowed. It began to appear on November 8th. On November 20th four bullocks were put in the pits to make manure for the half-plots, 10 B and 11 B. They fed until December 12th, a period of 22 days, having in that time consumed

2 cwts. 2 qrs. decorticated cotton-cake,
4 cwts. maize-meal,
30 cwts. white turnips,
5 cwts. wheat-straw chaff as food.

They also had 12 cwts. wheat-straw as litter, and drank 41 cwts. 2 qrs. of water. They were all quiet, and without exception took readily to their food. The weights on November 20th and December 12th were:—

	Put up, Nov. 20.			Removed, Dec. 12.			Gain in Live-Weight in Twenty-two Days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
Bullock No. 1	9	0	1	9	1	3	0	1	2
„ No. 2	8	3	0	8	2	14	Loss......		14
„ No. 3	9	3	23	10	1	0	0	1	5
„ No. 4	8	3	11	9	0	10	0	0	27
Total weight of 4 Bullocks ..	36	2	7	37	0	27	0	2	20

The bullocks, it will be seen, did not do at all well in the time; and not nearly so well as in the previous year. No. 2 was unwell, and off his feed for several days. They had 30 lbs. of roots per day each at first, increasing to 40 lbs. daily, other foods in proportion. The cake and meal used had the following compositions:—

	Decorticated Cotton-cake.	Maize-meal.
Moisture	4·99	12·47
Oil	16·90	4·53
*Albuminous compounds	45·68	8·87
Digestible fibre, starch, &c.	21·02	71·49
Woody fibre	4·97	1·10
Mineral matter	6·44	1·54
	100·00	100·00
* Containing nitrogen	7·31	1·42

The white turnips contained nitrogen .. .. ·22 per cent
The first lot of wheat-straw used contained nitrogen ·55 „
A second lot contained nitrogen .. .. ·25 „

The dung was at once removed from the pits, and stacked under cover until February 6th, a period of eight weeks, when it was weighed, the amount being 31 cwts. 18 lbs. From this, quantities calculated to yield respectively 100 lbs. and 200 lbs. ammonia per acre, were put on the half-plots, 10 B and 11 B, on the same day. The wheat by this time looked very strong and healthy, though showing as yet no perceptible difference in

TABLE I.—PRODUCE OF CONTINUOUS WHEAT. NINTH SEASON, 1885.

Plots.	Manures per Acre.	Produce per Acre.					
		Dressed Corn.			Straw, Chaff, &c.		
		Weight.	Number of Bushels.	Weight per Bushel.			
		lbs.		lbs.	cwts.	qrs.	lbs.
1	Unmanured	1176	21·3	55·2	17	2	0
2	200 lbs. ammonia-salts, containing 50 lbs. Ammonia	1767	31·2	56·6	25	2	10
3	275 lbs. nitrate of soda, containing Nitrogen = 50 lbs. Ammonia	1569	28·1	55·8	28	0	21
4	200 lbs. sulphate of potash, 100 lbs. sulphate of soda, 100 lbs. sulphate of magnesia, 3½ cwts. superphosphate of lime	1243	22·4	55·5	18	3	0
5	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime, and 200 lbs. ammonia-salts (in spring)	2219	37·5	59·1	33	1	14
6	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime, and 275 lbs. nitrate of soda (in spring)	2282	38·9	58·6	38	0	14
7	Unmanured	1210	21·9	55·3	16	3	25
8A	The same minerals as in 8B, and 400 lbs. ammonia-salts	2376	41·1	57·75	45	2	14
8B	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime	1464	24·7	59·3	20	0	18
9A	The same minerals as in 9B, and 550 lbs. nitrate of soda (in spring)	2314	40·0	57·8	53	0	20
9B	200 lbs. sulph. potash, 100 lbs. sulph. soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime	1052	18·0	58·5	17	1	16
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882)..	1126	19·3	58·4	16	3	2
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. ammonia, made from 672 lbs. decorticated cotton-cake, 1075 lbs. maize-meal, 8064 lbs. turnips, 1344 lbs. wheat-straw, as food; and 3174 lbs. wheat-straw as litter. Weight about 4 tons	1510	25·0	60·3	24	0	8
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882)..	1192	20·5	58·25	19	2	6
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1344 lbs. decorticated cotton-cake, 2150 lbs. maize-meal, 16,128 lbs. turnips, 2688 lbs. wheat-straw chaff, as food; and 6348 lbs. wheat-straw as litter. Weight about 8 tons ..	1900	31·8	59·75	29	1	4

the plots. Hoeing began on March 14th, and was finished the first time on the 24th. On the 27th, the nitrogenous top-dressings of ammonia-salts and nitrate of soda were sown on plots 2, 3, 5, 6, 8 A and 9 A, these being, as usual, sown by a broadcast manure distributor, after being mixed with three times their bulk of dry sand. At that time, plots 2 and 3 looked decidedly the thinnest in the field, thinner even than plot 1 (no manure). Plot 7 (unmanured for the 9th successive year) looked very well. Plots 2 and 3 looked rather frost-bitten. Early in April the land was again hoed, and then cross-hoed. The plots that had nitrogenous manures soon appeared of a much darker colour than those with mineral manures only. Fine warm weather came in April, and the plants made rapid progress. Any gaps were now filled up by transplanting. By April 20th, the effects of the top-dressings on plots 8 A and 9 A were plainly visible, the latter seeming then to be the best plot on the field. The dung on 10 B and 11 B also showed its efficacy as compared with the unmanured half-plots 10 A and 11 A. Plots 2 and 3 at this stage did not look better than the unmanured plots 1 and 7, but 5 and 6 were both good. Cold and also wet weather followed and made it difficult to get rid of the weeds, but this was successfully done by the end of May. The wheat came into ear about June 20th. In the later period, plots 2 and 3, which had been rather backward, came on well. Plots 8 A and 9 A, especially the latter, promised to be very heavy crops, while 5 and 6 were also capital. By the beginning of August nearly all the plots were quickly getting ready. A storm on the night of August 4-5, caused some of the wheat, notably on plot 9 A, to go down somewhat. On August 20th and 21st, the crop was cut, tied, and stacked. The produce was threshed in the field on October 21st, the straw weighed at once, and the grain stored in the granary, and weighed on Oct. 24th.

The results are given in Table I.

Speaking generally, the produce was lower than in 1884, and more like that of 1883.

The unmanured plots, the ninth successive crop, gave 21·3 and 21·9 bushels per acre, as against 23·1 and 26·6 bushels last year. Mineral mixtures alone only increased the produce to 22·4 bushels. 200 lbs. ammonia-salts per acre, on the other hand, gave a yield of 31·2 bushels, and 275 lbs. nitrate of soda of 28·1 bushels, the increase in either case being comparatively less than last year, ammonia-salts, as then, giving the higher yield. Minerals with 200 lbs. ammonia-salts per acre produced 37·5 bushels; and minerals with 275 lbs. nitrate of soda per acre 38·9 bushels, the nitrate having a slight advantage. With double the quantities of ammonia-salts and nitrate

of soda in conjunction with minerals, 41·1 and 40 bushels were obtained respectively, the yields in 1884, when no nitrogenous manures were applied, being 32·5 and 21·9 bushels. On the other hand, the plots which last year gave 48·8 and 51 bushels when manured with minerals and 400 lbs. ammonia-salts per acre in the first case, and minerals and 550 lbs. nitrate of soda in the second, now, on the omission of the nitrogenous manures for this single year, yielded only 24·7 and 18 bushels.

It will be noticed that the difference of produce of corn as between ammonia-salts and nitrate of soda has this year been practically nothing; but there has been a considerably larger yield of straw with the nitrate, 200 lbs. of ammonia-salts per acre giving 31·2 bushels of corn and 25 cwts. 2 qrs. 10 lbs. of straw, while 275 lbs. nitrate soda per acre gave 28·1 bushels of corn only, but as much as 28 cwts. 0 qr. 21 lbs. of straw. The double quantities, in conjunction with minerals, gave, in the case of ammonia-salts, 41·1 bushels of corn, with 45 cwts. 2 qrs. 14 lbs. of straw; in the case of nitrate of soda, 40 bushels of corn and 53 cwts. 0 qr. 20 lbs. of straw. The weight per bushel of the corn was much the same in either case. Where farmyard manure was applied at the rate of 4 tons per acre for the ninth successive year the yield was 25 bushels, or 4 bushels only above the unmanured plots; applied at the rate of 8 tons per acre it gave 31·8 bushels, against 38 bushels in 1884. Where farmyard manure had been given each year up to 1882, and omitted since then, only 19·3 and 20·5 bushels were produced, or rather less than on the unmanured plots.

Experiments on the Continuous Growth of Barley.

The land was grubbed up on August 25th, and afterwards ploughed. The dung for Plots 10 B and 11 B was made by four bullocks, which consumed the same amounts and kinds of food as those making the dung for the permanent wheat. The weights were as follows:—

	Put up, Nov. 20.			Removed, Dec. 12.			Gain in Live-weight in Twenty-two Days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
Bullock No. 1	8	2	1	8	2	11	0	0	10
„ No. 2	9	2	12	10	0	4	0	1	20
„ No. 3	8	3	8	8	3	18	0	0	10
„ No. 4	9	1	27	9	3	13	0	1	14
Total weight of 4 Bullocks ..	36	1	20	37	1	18	0	3	26

The gain here was rather more than in the case of the wheat experiment, but still small. The dung was removed on December 12th, and kept under cover. On February 6th it was weighed, 30 cwts. 2 qrs. 15 lbs. being the amount, and was spread out on plots 10 B and 11 B in quantities calculated to supply to them 100 lbs. and 200 lbs. of ammonia per acre respectively. On February 25th the land was ploughed a second time, the dung being thus ploughed in. After harrowing and rolling, mineral manures were sown on March 26th, and the seed drilled in on March 28th, at the rate of 9 pecks per acre, of "Oakshott's Golden Melon." The nitrogenous top-dressings were sown on April 27th. Shortly afterwards wireworms appeared in great numbers, and these had to be caught and destroyed. The plots were next hoed and harrowed. The barley came into ear about June 20th; the unmanured and mineral manured plots looked very poor and short in straw, and, as in the case of the wheat, plots 8 A and 9 A were the best, 8 A being rather the more forward; 5 and 6 looked also good crops. The barley was very little damaged by the storm of August 4-5. The crop was cut on the 25th of August, and carted the next day in excellent condition. On October 20th it was threshed and the straw weighed, the corn being weighed on October 23rd and 24th. The results are given in Table II., page 242.

With one exception the yield was lighter than in 1883. The unmanured plots gave for the ninth successive crop 21·8 bushels and 22·5 bushels, as against 32·3 and 33·3 bushels in 1884. Mineral manures gave no increase, 21 bushels being the produce. 200 lbs. ammonia salts per acre increased it to 34·5 bushels, and 275 lbs. nitrate of soda to 37·2 bushels; minerals added gave a further increase in each case to 48 and 50·3 bushels; while the same minerals with a double quantity (400 lbs.) of ammonia-salts gave 58·7 bushels, and a double quantity (550 lbs.) of nitrate of soda, 64·5 bushels, the latter being the highest produce of any of the plots. It will be observed that in the case of the barley, nitrate of soda did better than ammonia-salts. Where nitrogenous manures, though applied with minerals in 1884, were now omitted, the yields were 39·3 and 34·8 bushels only. With farmyard manure the crops were lighter than in 1884.

THE ROTATION EXPERIMENTS.

Since in 1885 Rotations 3 and 4 completed the second four-course rotation, beginning as they did in 1878 with seeds and roots respectively, while Rotations 1 and 2 had already completed this course, Nos. 3 and 4 will be considered first.

TABLE II.—PRODUCE OF CONTINUOUS BARLEY. NINTH SEASON, 1885.

Plots.	Manures per Acre.	Produce per Acre. Dressed Corn. Weight.	Number of Bushels.	Weight per Bushel.	Straw, Chaff, &c.		
		lbs.		lbs.	cwts.	qrs.	lbs.
1	Unmanured	1102	21·8	50·5	11	2	18
2	200 lbs. ammonia-salts, alone	1683	34·5	48·8	22	0	17
3	275 lbs. nitrate of soda, alone	1897	37·2	50·9	20	3	5
4	200 lbs. sulphate of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. magnesia, 3½ cwts. superphosphate of lime	1046	21·0	49·75	10	1	14
5	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwts. superphosphate of lime, and 200 lbs. ammonia-salts	2519	48·0	52·5	25	1	14
6	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulphate of magnesia, 3½ cwts. of superphosphate of lime, and 275 lbs. nitrate of soda	2754	50·3	54·7	27	2	6
7	Unmanured	1118	22·5	49·55	11	0	9
8A	The same minerals as in 8B, and 400 lbs. ammonia-salts	3040	58·7	51·8	32	2	10
8B	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwts. of superphosphate of lime ..	2038	39·3	51·8	18	3	14
9A	The same minerals as in 9B, and 550 lbs. of nitrate of soda	3488	64·5	54·1	39	2	14
9B	200 lbs. sulph. of potash, 100 lbs. sulph. of soda, 100 lbs. sulph. of magnesia, 3½ cwts. of superphosphate of lime	1812	34·8	52·0	15	1	4
10A	No manure (having received manure as 10B in each of the five seasons previous to 1882, but none in 1882)..	1222	25·3	48·25	13	0	20
10B	Farmyard-manure, estimated to contain nitrogen = 100 lbs. of ammonia, made from 672 lbs. decorticated cotton-cake, 1075 lbs. maize-meal, 8064 lbs. turnips, 1344 lbs. wheat-straw chaff, as food; and 3174 lbs. wheat-straw as litter. Weight about 4 tons	1550	30·2	51·25	15	2	0
11A	No manure (having received manure as 11B in each of the five seasons previous to 1882, but none in 1882)..	2076	39·6	52·4	19	0	12
11B	Farmyard-manure, estimated to contain nitrogen = 200 lbs. ammonia, made from 1344 lbs. decorticated cotton-cake, 2150 lbs. maize-meal, 16,128 lbs. turnips, 2688 lbs. wheat-straw chaff, as food; and 6348 lbs. wheat-straw as litter. Weight about 8 tons ..	2008	37·7	53·25	21	3	6

Rotation No. 3.—Four acres. 1878, seeds; 1879, wheat; 1880, mangolds; 1881, barley; 1882, seeds; 1883, wheat; 1884, swedes.

Barley, 1885.—The swedes grown in 1884 were pulled up on November 21st and following days, and weighed. The roots were fed off by sheep with only chaff as additional food, and the land was ploughed up afterwards. It was harrowed and rolled early in March, and on March 17th 8 pecks of "Golden Melon" barley per acre were sown. The barley came up well and strong, and was hoed and harrowed in May. Seeds were not sown among the barley, as had been done in the previous rotation.

The previous swede crop of 1884 had been manured per acre as follows:—

PLOT 1.—With dung, made from 1880 lbs. straw as litter; 5000 lbs. mangolds; 1250 lbs. wheat-straw chaff, and 1000 lbs. decorticated cotton-cake.

PLOT 2.—With dung, made from 1880 lbs. straw as litter; 5000 lbs. mangolds; 1250 lbs. wheat-straw chaff; and 1000 lbs. of maize-meal.

PLOT 3.—With dung, made from 1880 lbs. straw as litter; 5000 lbs. mangolds; 1250 lbs. wheat-straw chaff; and artificial manure, containing two-thirds as much nitrogen, and other constituents, as the manure from 1000 lbs. decorticated cotton-cake; namely, 248 lbs. nitrate of soda, 100 lbs. of bone-ash (made into superphosphate), 62½ lbs. sulphate of potash, and 65 lbs. sulphate of magnesia.

PLOT 4.—With dung, made from 1880 lbs. straw as litter; 5000 lbs. mangolds; 1250 lbs. wheat-straw chaff; and artificial manure, containing as much nitrogen, and other constituents, as the manure from 1000 lbs. maize-meal; namely, 80 lbs. nitrate of soda, 16¼ lbs. bone-ash (made into superphosphate), 7 lbs. sulphate of potash, and 11 lbs. sulphate of magnesia.

No further manure was applied to any of the plots, except plot 3, to which nitrate of soda, to make up the remaining one-third of the nitrogen equivalent to that in the manure from 1000 lbs. of decorticated cotton-cake, was applied as a top-dressing on May 7th. As the barley-crop ripened, it appeared to be a splendid crop, No. 3 looking, if anything, the best. It was cut, tied, and stacked, on August 19th, and carted on the 20th. The results are given in Table III., p. 244.

The fact that such heavy yields of barley, as heavy, in fact, as the highest produce of the plots 8A and 9A in the Continuous Experiments on Barley, could be grown even on the maize-meal plot and its equivalent in artificials, affords strong confirmation of the view entertained that the land is, by previous manuring, already so rich as to be able to produce a maximum crop, with the addition of maize-meal, so that the superiority of decorticated cotton-cake has not had an opportunity of showing itself.

TABLE III.—PRODUCE OF BARLEY (ROTATION NO. 3), IN 1885, AFTER SWEDES FED ON THE LAND.

Plots of One Acre.		Dressed Corn.						Straw, Chaff, &c.
		Head-Corn.			Tail-Corn.			
		Weight.	Bushels.	Weight per Bushel.	Weight.	Bushels.	Weight per Bushel.	
		cwts. qrs. lbs.		lbs.	cwts. qrs. lbs.		lbs.	tons. cwts. qrs. lbs.
1	Without artificials (cotton-cake plot) ..	28 3 1¼	60·3	53·4	0 3 3¾	2·1	41·75	1 18 2 23
2	Without artificials (maize plot)	27 1 20	57·1	53·8	0 2 3¾	1·5	39·75	1 16 3 22¾
3	With artificial manure, containing one-third as much nitrogen as the manure from 1000 lbs. decorticated cotton-cake, namely, 124 lbs. nitrate of soda	29 1 4¾	61·2	53·6	0 3 23¾	2·5	43·6	2 5 3 24
4	Without artificial manure	28 0 3¼	58·3	53·8	0 2 12¾	1·6	41·75	1 19 3 3¼

This concludes the second four-course rotation of No. 3.

Rotation No. 4.—Four acres. 1878, mangolds; 1879, barley; 1880, seeds; 1881, wheat; 1882, swedes; 1883, barley; 1884, seeds.

Wheat, 1885.—The seeds sown among the barley of 1883 had been eaten off by sheep, which consumed on plot 1, 672 lbs. of decorticated cotton-cake, as additional food; on plot 2, 728 lbs. maize-meal; but on plots 3 and 4 no additional food. On October 20th, the land was ploughed; and on the 28th, 8 pecks of Browick wheat to the acre were drilled. Mineral manures were sown on plots 3 and 4 on November 7th, and nitrogenous top-dressings on the same plots on March 28th, these artificial manures being the equivalents of the decorticated cotton-cake dung and maize-meal dung respectively. The wheat was in ear about June 20th, and looked remarkably strong. It was cut August 24th and 25th, and carted on the 25th and 26th. The yield is given in Table IV., page 246.

Here, again, as in Rotation 3, we have strong evidence in support of the view expressed as to the production of a maximum crop by means of the maize-meal alone as additional food, the produce on this rotation being 10 bushels higher than was obtained on the best plots in the continuous wheat experiments.

Rotation 1.—Four acres. 1885, peas and tares. On commencing a new rotation, it was decided, in consequence of the superiority of decorticated cotton-cake over maize-meal not having been brought out in the rotation experiments, probably on account of the large amount of unexhausted manures in the soil, to alter the plan of carrying on these experiments. With the view of exhausting the soil of this supposed over-fertility, and also to continue side by side the original enquiry, it was resolved to divide each rotation, and to grow on one-half of the land a crop in rotation without manure and to be carted off entirely, but on the other half feeding off a crop with decorticated cotton-cake and maize-meal, as additional foods respectively. Accordingly, the four plots of rotation 1 were divided by a cross path into 8 plots of half an acre each. Since barley was the crop grown in 1884, the land would in 1885 have come in for seeds, but none having been sown among the barley, the only plan was to plant over the 2 acres, comprising one-half of the rotation, white peas at the rate of 9 pecks to the acre, growing them without manure, and on the other half of the rotation (2 acres) spring tares at the rate of 9 pecks to the acre. This was accordingly done on April the 6th and 7th. Both crops came up well, but the prolonged drought which followed, together with blight, completely spoiled them, and, unfortunately, rendered the results obtained not worth recording.

TABLE IV.—PRODUCE OF WHEAT (ROTATION NO. 4), IN 1885, AFTER SEEDS FED ON THE LAND IN 1884.

Plots of One Acre.		Dressed Corn.						Straw, Chaff, &c.
		Head-Wheat.			Tail-Wheat.			
		Weight.	Bushels.	Weight per Bushel.	Weight.	Bushels.	Weight per Bushel.	
		cwts. qrs. lbs.		lbs.	cwts. qrs. lbs.		lbs.	tons. cwts. qrs. lbs.
1	Seeds fed off by sheep, which consumed 672 lbs. of decorticated cotton-cake ..	24 2 13¾	47·7	57·8	0 2 10¾	1·7	39·75	2 18 1 14
2	Seeds fed off by sheep, which consumed 728 lbs. of maize-meal	27 0 2½	51·0	59·3	0 3 16½	2·1	48·25	2 17 0 4½
3	Seeds fed off by sheep without cake or corn, top-dressed in spring with artificial manures, containing as much nitrogen, potash, phosphoric acid, &c., as the dung from 672 lbs. of decorticated cotton-cake	22 3 21¾	43·7	58·8	0 1 19¾	1·1	44·0	2 12 2 21½
4	Fed off by sheep without cake or corn, top-dressed in spring with artificial manures, containing as much fertilising matter as the dung from 728 lbs. of maize-meal ..	23 3 16	45·5	58·8	0 2 26¾	2·0	42·2	2 8 1 22¾

Wheat will follow on this rotation.

Rotation 2.—Four acres. 1885, swedes and mangolds. This rotation, now commencing, has been divided similarly to rotation 1, but wheat having been the crop in 1884, roots would ordinarily have followed in 1885. Accordingly 2 acres were used for growing mangolds without manure, these to be carted entirely off the field, and on the other 2 acres swedes were grown with the addition of 3 cwt. per acre of mineral superphosphate to ensure a crop, the swedes, or a portion of them, to be fed off on the land by sheep receiving decorticated cotton-cake and maize-meal respectively, and also with no additional food, according to the original plan. The rotations have been divided crosswise, and the same plots on which cake and meal were separately consumed before will be again used for the consumption on them of these foods again.

Mangolds were drilled on 2 acres of the rotation on May 2nd; and on the 18th, on the other 2 acres, 3 cwts. of mineral superphosphate per acre were sown, and 3 lbs. of swede seed per acre drilled in. The swedes and mangolds both came up well, and in spite of the severe drought, fair crops were obtained, considering the season. The mangolds were got up by November 7th, carted, and weighed. The swedes were pulled on November 27th. The weights were:—

TABLE V.—PRODUCE of SWEDES and MANGOLDS in 1885 (ROTATION No. 2) after WHEAT.

	SWEDES. Produce per Acre.								MANGOLDS. Produce per Acre.							
	Roots.				Leaves.				Roots.				Leaves.			
	Tons.	cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs	Tons.	cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.
Decorticated Cotton-cake Plot	17	0	2	22	1	13	3	12	11	6	0	12	1	16	0	24
Maize-meal Plot	17	0	0	16	1	16	2	14	11	1	0	24	1	18	3	20
Equivalent in Artificials to Decor. Cotton-cake ..	14	7	2	4	1	16	2	18	13	1	0	20	1	16	3	24
Equivalent in Artificials to Maize-meal	13	15	2	20	1	17	0	2	10	16	2	8	2	3	1	8

The fact that 17 tons of swedes to the acre have been grown in such a season as the past, without any other manure than

mineral superphosphate, points strongly to an accumulated amount of nitrogen in the soil, the residue of previous manurings. It will be noticed that here, too, there is no apparent difference between the effects of the decorticated cotton-cake and the maize-meal. Samples of the soil of these two new rotations, 1 and 2, have been carefully taken, with a view to elucidate the point raised.

TABLE VI.—PRODUCE of BARLEY in LANSOME FIELD in 1885.

PLOTS. ¼ Acre.	Manures used per Acre.	Weight of Barley.			Bushels.	Weight per Bushel.	Straw, &c.		
		Cwts.	qrs.	lbs.			Cwts.	qrs.	lbs.
1	No Manure	8	0	25	18·7	49·12	13	0	14
2	With dung made from 9 cwts. decorticated cotton-cake, 120 cwts. white turnips, 20 cwts. wheat-straw chaff, and 48 cwts. wheat-straw as litter; weight about 4 tons	12	1	22	27·55	50·6	13	2	27
3	With decorticated cotton-cake meal, pulped roots and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 2, but applied direct to the land ..	14	1	12	31·4	51·18	19	0	7
4	No Manure	10	2	17	23·7	50·35	12	0	11
5	With dung made from 9 cwts. maize-meal, 120 cwts. white turnips, 20 cwts. wheat-straw chaff, and 48 cwts. wheat-straw as litter; weight about 4 tons	8	2	10	19·0	50·5	10	2	7
6	With maize-meal, pulped roots, and wheat-straw chaff, containing the same amount of manurial constituents as the dung in No. 5, but applied direct to the land	10	1	9	23·46	49·25	10	1	22

EXPERIMENTS ON THE COMPARATIVE MANURIAL VALUES OF DECORTICATED COTTON-CAKE AND MAIZE-MEAL, CONDUCTED IN LANSOME FIELD (LIGHT LAND).

It was decided, with a view to aid the above inquiry, to institute further experiments on the poor and light soil of Lansome Field.

Barley was the crop selected to commence with; the plan of

manuring and results obtained are given in Table VI. The plots selected are those which were known from previous experiments in this field to be the most uniform obtainable. The meals were applied direct to the land, together with the pulped roots and straw-chaff, and the whole were ploughed in before sowing the barley. The dung was made by bullocks, which consumed in the boxes the stated quantities of food, the dung and meals being put on about the same time, viz., March 13–18th. The cake and meal used were the same as in the wheat and barley experiments. Barley, at the rate of 9 pecks per acre, was drilled on March 26th. Red clover has been sown among the barley. The yield of barley has been very small. The crop was cut and stacked August 26–28th, and threshed November 17–20th. The highest result has been obtained from the application of decorticated cotton-cake meal direct, and the next best from the cotton-cake dung.

Experiments with soluble and finely ground Phosphatic Fertilisers in Warren Field (Strong Land).

The new rotation began in 1884 with swedes, and barley followed in 1885. The plan of manuring, and the results of the barley-crop, are given on Table VII., pp. 250, 251.

The barley—9 pecks per acre—was drilled on March 23rd to 24th; it was ready by August 28th, when it was cut and stacked. It was threshed on November 17th and 18th. Red clover has been sown among the barley.

The want of uniformity in the soil of Warren Field, as has been noted in previous reports, renders these results of rather doubtful value.

Rainfall at Woburn during 1885, taken at 8 a.m. daily at Crawley Mill Farm.

	Inches.
January	1·36
February	1·74
March	1·03
April	2·44
May	2·93
June	1·78
July	·17
August	2·55
September	4·10
October	3·69
November	3·45
December	·73
Inches	25·97

Table VII.—Produce of Barley in Warren Field

Plots. Section A.	Manure used for Swedes in 1884, and Cost per Acre.	Weight of Barley per Acre.				Number of Bushels.	Weight per Bushel.	Straw, &c.			
		Tns.	cwts.	qrs.	lbs.		lbs.	Tns.	cwts.	qrs.	lbs.
1. 1st half	3 cwt. ground coprolites; cost 12*s.* ..	1	1	1	2	43·9	54·3	1	3	1	26
2nd half	6 cwt. ground coprolites; cost 24*s.* ..	1	0	2	14	42·7	54·05	1	4	2	16
2. 1st half	3 cwt. dissolved coprolites; cost 12*s.* ..	1	4	3	2	51·5	54·25	1	6	2	18
2nd half	6 cwt. dissolved coprolites; cost 24*s.* ..	1	6	1	8	54·3	54·25	1	9	0	24
3. 1st half	3 cwt. Redonda phosphate; cost 10*s.* 6*d.*	1	3	1	1	48·9	53·6	1	7	1	10
2nd half	6 cwt. Redonda phosphate; cost 21*s.* ..	1	4	0	22	50·7	53·5	1	7	1	10
4. 1st half	3 cwt. dissolved bones; cost 19*s.* 6*d.*	1	3	1	14	50·0	52·37	1	7	1	18
2nd half	6 cwt. dissolved bones; cost 39*s.*	1	2	0	2	46·3	53·25	1	5	3	26
5. 1st half	2 cwt. dissolved coprolites; cost 8*s.*	0	19	3	14	42·1	52·8	1	1	2	8
2nd half	4 cwt. dissolved coprolites; cost 16*s.* ..	0	17	3	22	38·4	52·37	1	3	1	16
6. 1st half	No manure	0	17	1	8	40·6	47·8	1	3	1	4
2nd half	No manure	0	19	1	2	43·16	50·0	1	2	3	22
7. 1st half	3 cwt. bone-meal; cost 22*s.* 6*d.*	1	1	3	20	45·2	54·25	1	6	3	22
2nd half	6 cwt. bone-meal; cost 45*s.*	0	19	3	12	41·2	53·95	1	3	1	8
8. 1st half	10 tons dung; cost 50*s.*	1	2	2	18	46·6	54·45	1	10	2	0
2nd half	20 tons dung; cost 100*s.*	1	3	0	24	47·6	54·6	1	10	3	22
9. 1st half	10 tons dung and 3 cwt. dissolved coprolites; cost 62*s.*	0	18	1	22	38·5	53·6	1	2	3	2
2nd half	10 tons dung and 6 cwt. dissolved coprolites; cost 74*s.*	0	18	0	18	37·9	53·6	1	1	2	18
10. 1st half	10 tons dung and 3 cwt. ground coprolites; cost 62*s.*	1	0	2	18	42·8	54·05	1	4	0	22
2nd half	10 tons dung and 6 cwt. ground coprolites; cost 74*s.*	1	0	3	0	43·2	53·7	1	6	3	2
11. 1st half	2 cwt. dissolved coprolites; cost 8*s.* .. .,	0	19	2	24	42·1	52·4	1	5	2	6
2nd half	4 cwt. dissolved coprolites; cost 16*s.* ..	0	18	2	8	40·5	51·3	1	1	3	18
12. 1st half	2 cwt. dissolved coprolites and 1 cwt. nitrate of soda; cost 18*s.*	0	18	0	16	40·8	49·75	1	1	3	2
2nd half	4 cwt. dissolved coprolites and 2 cwt. nitrate of soda; cost 36*s.*	1	0	3	6	44·7	52·15	1	5	3	2

in 1885. Plots $\frac{1}{4}$ Acre each, divided into halves.

Plots. Section B.	Weight of Barley, and Cost per Acre.				Number of Bushels.	Weight per Bushel.	Straw, &c.				Average of Duplicates.			
	Tns.	cwts.	qrs.	lbs.			Tns.	cwts.	qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. 1st half	0	14	0	14	31·0	51·0	0	18	1	6	0	17	2	22
2nd half	0	18	3	16	42·4	49·9	1	5	1	10	0	19	3	1
2. 1st half	1	1	2	10	44·1	54·8	1	5	2	10	1	3	0	20
2nd half	0	17	3	0	37·5	53·0	1	1	3	10	1	2	0	4
3. 1st half	1	0	1	4	41·8	54·35	1	4	1	18	1	1	3	2
2nd half	1	0	2	24	42·7	54·35	1	4	0	14	1	2	1	23
4. 1st half	1	1	3	24	45·0	54·65	1	6	0	6	1	2	2	19
2nd half	1	0	0	4	41·3	54·35	1	6	1	10	1	1	0	3
5. 1st half	1	0	2	6	42·4	54·25	1	4	3	18	0	19	4	24
2nd half	1	1	2	20	44·4	54·7	1	4	3	20	0	19	3	7
6. 1st half	1	5	3	14	54·4	53·25	1	14	2	4	1	1	2	11
2nd half	1	1	3	14	46·8	52·3	1	8	2	0	1	0	2	8
7. 1st half	0	18	1	12	38·5	53·44	1	3	0	2	0	19	4	16
2nd half	1	2	0	26	50·5	49·37	1	9	2	18	1	0	4	5
8. 1st half	1	6	3	18	54·6	55·17	1	9	1	12	1	4	3	5
2nd half	1	8	0	6	57·0	55·1	1	11	2	16	1	5	2	15
9. 1st half	1	3	0	16	47·9	54·1	1	6	3	20	1	0	3	5
2nd half	1	4	3	10	51·2	54·37	1	8	1	26	1	1	2	0
10. 1st half	1	4	1	10	50·5	54·0	1	6	3	24	1	2	2	0
2nd half	1	3	3	12	49·7	53·83	1	6	3	6	1	2	1	6
11. 1st half	1	4	3	18	51·4	54·25	1	9	0	22	1	2	1	7
2nd half	1	6	2	0	55·7	53·25	1	9	1	6	1	2	2	4
12. 1st half	1	0	0	2	42·7	52·55	0	19	2	18	0	19	0	9
2nd half	0	17	1	10	37·2	52·12	1	3	0	16	0	19	0	8

RAINFALL in 1882, 1883, 1884, 1885.

	1882.	1883.	1884.	1885.
Inches	28·14	24·20	17·84	25·97

DURING the HARVEST MONTHS of AUGUST and SEPTEMBER, the RAINFALL was—

	1883.	1884.	1885.
Inches	4·65	2·76	6·65

VII.—*Report on the Experiments with Clovers at Woburn.* By WM. CARRUTHERS, F.R.S., Consulting Botanist to the Society.

THESE experiments were instituted with the view of observing the duration of the life of the different species of clover in ordinary cultivation. While this was being tested, it was resolved, on the recommendation of the late Dr. Voelcker, to try the value of different manures, and see if the action of these manures on the clovers would throw any light on clover sickness.

Plots were set apart for the experiments, both in the Stackyard-field, with its light sandy soil, and in the Warren-field, with its heavy loam. Each plot was twelve feet square. Six different samples of clover were sown under seven different kinds of treatment; there were consequently in each field forty-two plots. The clovers sown were two samples (A. and B.) of perennial red clover, one each of cowgrass and alsike, and two of white clover, one of them purporting to be English grown, the other Dutch. One of the plots had no manure. The second plot had at the rate of 4 cwt. of bone-dust and 4 cwt. of superphosphate to the acre. The third plot had at the rate of 4 cwt. of sulphate of potash to the acre. The fourth plot at the rate of 2 cwt. of sulphate of ammonia. The fifth plot at the rate of 2 cwt. of nitrate of soda. The sixth plot at the rate of 4 cwt. of bone-dust, 4 cwt. of superphosphate, 4 cwt. of sulphate of potash, and 2 cwt. of sulphate of ammonia. And the seventh plot had at the rate of 4 cwt. of bone-dust, 4 cwt. of superphos-

phate, 4 cwt. of sulphate of potash, and 2 cwt. of nitrate of soda. The manures were sown in the Stackyard-field on the 28th of March, 1883, the 19th of March, 1884, and on the 26th of March, 1885. In the Warren-field, they were sown on the 31st of March, 1883, the 22nd of April, 1884, and on the 3rd of April, 1885.

The various plots were thoroughly weeded.

The crops for 1883 and 1885 were weighed. No record was kept of the crops of 1884.

With the view of seeing whether the life of the clovers was affected by permitting the plants to go to seed, one-half of each plant was mown just as the clover came into flower. The other half was cut when it was in full seed, and the crop was carefully removed so as to prevent, if possible, any of the seeds being shed on the plot. This treatment was further intended to represent, as far as it could be done in such small plots, the different effects of grazing and haying the clovers.

The first point for investigation was the longevity of the various clovers; the bearing of the experiments on this point will be apparent when the crops of the two years are compared.

TABLE I.—PERENNIAL RED CLOVER, A.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	6	$11\frac{1}{4}$	12	1	2	$18\frac{3}{4}$	..	$11\frac{3}{4}$	..	15	3	$10\frac{1}{2}$
2. Bone-dust and Superphos.	7	20	14	11	0	24	..	$19\frac{1}{4}$	1	5	3	$22\frac{3}{4}$
3. Sulphate of Potash	8	$4\frac{3}{4}$	15	8	1	$17\frac{1}{4}$	1	$11\frac{1}{2}$	2	13	1	$0\frac{1}{2}$
4. Sulph. of Ammonia	7	$12\frac{1}{4}$	14	0	3	$1\frac{3}{4}$	..	$19\frac{1}{4}$	1	5	3	$22\frac{3}{4}$
5. Nitrate of Soda ..	7	$24\frac{1}{4}$	14	16	3	$21\frac{3}{4}$	..	$27\frac{1}{4}$	1	16	2	$26\frac{3}{4}$
6. 2 and 3, with 4 ..	8	$2\frac{1}{4}$	15	5	0	$3\frac{3}{4}$	..	25	1	3	2	23
7. 2 and 3, with 5 ..	7	$15\frac{3}{4}$	14	5	1	$26\frac{1}{4}$	..	$25\frac{1}{2}$	1	14	1	$14\frac{3}{4}$

This table shows that the perennial red clover had practically disappeared in 1885. The produce of the seven plots in 1883 amounted to 13 cwt. 1 qr. $6\frac{1}{2}$ lbs., while that of 1885 was only 1 cwt. 1 qr. $27\frac{1}{2}$ lbs. I examined the plots on the 28th of September, 1885, and found that their state then confirmed the results of the cropping. The plot with most plants in both fields was that which was manured with sulphate of potash. In all the other plots the clovers had almost, or altogether, disappeared.

Table II.—Perennial Red Clover, B.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	8	0¼	15	2	1	9¾	..	22½	1	10	1	9½
2. Bone-dust and Superphos.	8	12¼	15	18	2	1¾	..	22¾	1	10	2	19¼
3. Sulphate of Potash	8	9¾	15	15	0	16¼	..	21¾	1	9	1	8¼
4. Sulph. of Ammonia	8	13½	16	0	0	22½	..	10	..	13	1	26
5. Nitrate of Soda ..	8	18¼	16	6	2	11¾	..	12¾	..	17	0	21¼
6. 2 and 3, with 4 ..	9	0	16	19	3	0	..	17¾	1	3	3	20¼
7. 2 and 3, with 5 ..	8	26¼	16	17	1	15¾	..	23	1	11	0	1

This sample gives almost identical results as the other perennial red clover. The produce of the seven plots in 1883 amounted to 14 cwt. 3 qrs. 24¼ lbs., while that of 1885 was only 1 cwt. 0 qrs. 18½ lbs. In the Stackyard-field there was not a single plant in any of the plots of this clover in September, 1885. In the Warren-field the best plot was that manured with sulphate of potash only. In all the other plots only a few plants still existed.

Table III.—Cowgrass.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	8	22½	16	12	1	9½	2	22	5	5	0	18
2. Bone-dust and Superphos.	7	26¾	15	0	1	7¼	2	7¼	4	5	1	2¾
3. Sulphate of Potash	9	8½	17	11	0	23½	3	11	6	8	0	19
4. Sulph. of Ammonia	9	3	17	3	3	5	2	19¾	5	2	0	14¼
5. Nitrate of Soda ..	9	15	17	19	3	25	3	1¾	5	15	2	12¼
6. 2 and 3, with 4 ..	9	11¾	17	15	2	10½	3	6¾	6	2	1	11¼
7. 2 and 3, with 5 ..	9	3	17	3	3	5	3	16¼	6	15	0	17¾

The produce of the seven plots of cowgrass in 1883 amounted to 15 cwt. 3 qrs. 6½ lbs., while in 1885 it was 5 cwt. 1 qr. 0¾ lb. Though the amount in 1885 is only a third of the produce of 1883, yet it shows that the plant known in the trade as cowgrass is a more enduring plant than perennial red clover, though it is only a variety of the same species, *Trifolium perenne*, Linn. In September 1885, there were plants in all the

plots, excepting No. 4, with the sulphate-of-ammonia manure; and though there were more than in the plots of perennial red clover, they were yet very sparse.

TABLE IV.—ALSIKE.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	8	7½	15	12	0	12½	2	24	5	7	3	12
2. Bone-dust and Superphos.	11	0½	20	15	3	19½	3	16	6	14	3	8
3. Sulphate of Potash	10	21	20	5	3	7	4	16½	7	13	0	27½
4. Sulph. of Ammonia	9	21½	18	8	2	26½	3	10	6	6	2	26
5. Nitrate of Soda ..	9	26½	18	15	1	25½	3	19¾	6	19	3	14¼
6. 2 and 3, with 4 ..	9	21½	18	8	2	26½	4	4	7	16	1	16
7. 2 and 3, with 5 ..	10	3¾	19	2	2	6¼	4	7¾	8	0	3	2¾

The whole produce of the plots for 1883 was 17 cwt. 1 qr. 18¼ lbs., while that of 1885 was 6 cwt. 2 qrs. 13½ lbs. The plots in the Warren-field were better than those in the Stackyard-field in September, 1885, but in all there were only a few scattered plants to be found.

TABLE V.—WHITE CLOVER, ENGLISH GROWN.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	5	22½	10	19	0	9½	2	13	4	12	4	3
2. Bone-dust and Superphos.	6	6½	11	15	1	1½	2	12¾	4	12	2	21¼
3. Sulphate of Potash	6	15	12	6	2	25	3	3¼	5	17	2	14¾
4. Sulph. of Ammonia	6	13¼	12	4	1	12¾	2	12¾	4	12	2	21¼
5. Nitrate of Soda ..	7	2½	13	7	2	13¼	2	27¼	5	12	0	26¾
6. 2 and 3, with 4 ..	7	13¾	14	2	3	4¼	3	12½	6	9	3	11½
7. 2 and 3, with 5 ..	7	11¾	14	0	0	10¼	3	14¾	6	13	0	15¼

The produce of the seven plots of this clover in 1883 amounted to 11 cwt. 3 qrs. 1¼ lbs., as against 5 cwt. 12¼ lbs. in 1885. The plots were fairly covered with plants; those with sulphate of ammonia and nitrate of soda were the poorest, while the plots with sulphate of potash alone, or with this manure in combination with others (6 and 7), were the best.

TABLE VI.—WHITE CLOVER, DUTCH GROWN.

	1883.						1885.					
	Plot.		Per Acre.				Plot.		Per Acre.			
	Qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Qrs.	lbs.	Tns.	cwts.	qrs.	lbs.
1. No Manure	5	27¼	11	4	1	26¾	..	23½	1	11	2	20½
2. Bone-dust and Superphos.	7	3	13	8	1	5	1	4¾	2	4	0	7¼
3. Sulphate of Potash	7	9½	13	17	0	6½	1	5	2	4	1	27
4. Sulph. of Ammonia	7	2½	13	7	2	13½	1	5¾	2	5	2	0¼
5. Nitrate of Soda ..	7	7¾	13	14	2	22¼	1	5½	2	5	0	18½
6. 2 and 3, with 4 ..	8	7¾	15	12	1	22¼	1	13¼	2	15	2	12¾
7. 2 and 3, with 5 ..	8	2	15	4	2	22	1	9½	2	10	2	6½

The produce of the seven plots of this clover in 1883 amounted to 12 cwt. 3 qrs. 3¾ lbs., while in 1885 it was 2 cwt. 0 qr. 11¼ lbs. Plot 6 was the best in both fields, and the others were very nearly equal.

The testimony given to the duration of the life of those various clovers will be more apparent if the total yields of the seven plots of each sample for 1883 be compared with those of 1885, and the relative proportions of these yields be noted.

TABLE VII.—TOTAL YIELD of the SEVEN PLOTS.

	1883.			1885.			No. of times less.
	Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	
Perennial Red Clover, A.	13	1	6½	1	1	27½	9·
Perennial Red Clover, B.	14	3	24¼	1	0	18½	13·
Cowgrass	15	3	6½	5	1	0¾	3·
Alsike	17	1	18¼	6	2	13½	2·63
English White Clover ..	11	3	1¼	5	0	12¼	2·3
Dutch White Clover ..	12	3	3¾	2	0	11¼	6·36

This table shows that both the perennial red clovers had nearly disappeared—in the one sample the yield, in 1885, being only $\frac{1}{13}$th of that in 1883, and in the other $\frac{1}{9}$th. The next to show marked deterioration is the Dutch-grown white clover, when the decrease was more than a sixth. The cowgrass of commerce, though, as I believe, only a variety of *Trifolium perenne*, Linn., or perennial red clover, shows a much greater power of maintaining its life, giving a crop only one-third less in 1885 than in the former year. Alsike was scarcely one-third less, while English-grown white clover yielded nearly one-half the crop in 1885 that it produced in 1883.

The experiments would have been carried on till the clovers

had disappeared, had it not been that in 1884 fresh seed was sown in some of the plots to fill up the bare places, the object of the experiments not having been clearly understood. As this to some extent vitiated the results, it was resolved to dig up all the plots and to resow them, using the same varieties of clover for the same plots, and using also the same manures in each plot. They were accordingly dug up in the end of the year, and will be resown in the spring.

In considering the remarkable decrease in the yields of the two years, it should be remembered that, except in the few cases in which the seeds were added in 1884, no fresh plants were introduced into the plots. The plants that were produced from seed sown in 1882 gradually died out in the cases of the red clovers; while in the others they, to some extent, died out, and in all these cases yielded a much smaller produce than in the first year.

The effect on the life of the plant of permitting it to go to seed, or, on the other hand, of cutting it as soon as it came into flower, is shown in the following two tables, where the produce of each kind of clover for the two years is contrasted.

TABLE VIII.—PRODUCE OF EACH HALF of the SEVEN PLOTS in 1883.

	The Half Cut when coming into Flower.							The Half Cut when in Seed.						
	Plot.			Per Acre.				Plot.			Per Acre.			
	Cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.
Perennial Red, A.	8	1	15	9	4	1	22	4	3	19¼	5	8	1	9
Perennial Red, B.	8	2	4	9	7	3	4	6	1	20¼	7	1	1	25½
Cowgrass	9	2	7	10	10	1	14	6	0	27½	6	17	1	17
Alsike	10	1	3	11	6	0	10	7	0	15¼	7	16	3	27½
English White ..	6	0	13	6	14	2	6	5	2	16¼	6	4	0	21½
Dutch White ..	6	3	25¾	7	13	2	6½	5	3	6	6	7	2	20

TABLE IX.—PRODUCE OF EACH HALF of the SEVEN PLOTS in 1885.

	The Half Cut when coming into Flower.							The Half Cut when in Seed.						
	Plot.			Per Acre.				Plot.			Per Acre.			
	Cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Tons.	cwts.	qrs.	lbs.
Perennial Red, A.	..	3	26½	1	1	2	21	..	2	1	..	11	0	22
Perennial Red, B.	..	2	15	..	13	3	22	..	2	3½	..	11	2	21
Cowgrass	3	0	17	3	9	1	10	2	0	11¾	2	6	1	6½
Alsike	4	1	4¼	4	14	1	9½	2	1	9¼	2	11	1	7½
English White ..	3	0	21½	3	10	0	25	1	3	18¾	2	2		14½
Dutch White ..	1	1	17¼	1	10	3	15½	..	2	22	..	15		8

In 1883, the halves of the plots coming into flower were cut in the Stackyard-field at the following dates—the two perennial reds and the two whites on the 12th of June, the alsike on the 18th of June, and the cowgrass on the 10th of July. In each case there was a sufficient after-growth to be cut again—the white clovers on the 23rd of July, the perennial reds on the 14th of August, the alsike on the 20th of September, and the cowgrass on the 12th of November. Only the white clovers produced a third growth, and this was cut on the 23rd of October. The dates in the Warren-field were the same, except that the first cutting of the red clover was six days later, and the second cutting fully a month later.

In 1885, these halves were first cut in the Stackyard-field at the following dates—the white clovers on the 15th of June, the red clovers on the 26th of June, and the cowgrass and alsike on the 11th of July. There was no after-growth, except in the case of the white clovers, and this was cut on the 20th of July. The dates in the Warren-field were the same, except that the first cutting of the cowgrass was on the 17th of July, and the alsike on the 2nd of July.

In 1883, the halves of the plots allowed to seed were cut in the Stackyard-field at the following dates:—the white clovers on the 17th of July, the alsike on the 23rd of July, and the red clovers and cowgrass on the 14th of August. Only the white clovers yielded a second growth, which was cut on the 23rd of October. In the Warren-field the dates were, for the first cutting—the white clovers on the 10th of July, the alsike and the two red clovers on the 23rd of July, and the cowgrass on the 14th of August. Here also the white clovers only yielded a second cutting, which was taken on the 22nd of October.

In 1885, these halves were first cut in the Stackyard-field at the following dates—the white clovers on the 18th of July, the cowgrass on the 20th of July, the red clovers and alsike on the 24th of July. None of the clovers yielded a second cutting. The dates in the Warren-field were the same, except that the cowgrass was a week later; and there was no second growth here.

In contrasting the greater bulk produced by the early-cut half with that of the later-cut half, it must be observed that three cuttings of the white clovers, and two of the others, were obtained for the first; whereas no second cutting was obtained from any of the clovers, except the whites, in the half when the plants were allowed to seed.

Very little difference could be detected in the two halves of the various plots in 1885, but a comparison of the produce shows that the plants which were not allowed during the previous years to go on to maturity, were the most vigorous.

From this it would appear that the clovers in permanent pasture have a longer life than the same species or varieties of clovers when used for making hay, if they are allowed to ripen their seeds.

The influence of the manures on the produce is made apparent by the following Table, in which the whole produce, calculated at the rate per acre, is given of the different clovers.

TABLE X.—TOTAL PRODUCE of all the CLOVERS in relation to the MANURES.

	Yield per Acre.	
	Tons.	cwts.
1. No Manure	8	8
2. Bone-dust and Superphosphate	9	8
3. Sulphate of Potash ..	10	2
4. Sulphate of Ammonia ..	9	6
5. Nitrate of Soda	9	17
6. 2 and 3, with 4	10	7
7. 2 and 3, with 5	10	6

The manure which has been of most value to the clovers has been the sulphate of potash. The addition of the bone-dust, superphosphate, and nitrogenous elements, in Plots 6 and 7, has given no appreciable advantage.

The bearing, if there be any, of the different manures on clover sickness, has not yet manifested itself. This, and the connection or confirmation of the results exhibited in this Report, will be secured by the renewal of the experiments.

VIII.—*The Silo and Silage-stack Competition*, 1885–86.

List of Judges.

G. W. BAKER, Luton Hoo Park.
JOHN KERSLEY FOWLER, Lee Manor, Great Missenden.
JAMES LONG, Graveley Manor, Stevenage.
THOMAS RIGBY, Sutton Weaver, Preston Brook.
JOHN WHEATLEY, Watford, Herts.
TOM PARRY, 9, Upper Woburn Place, W.C.

I. INTRODUCTION. By TOM PARRY, of 9, Upper Woburn Place, W.C.

THE Prize of 100 guineas (offered by Sir Massey Lopes, President of the Royal Agricultural Society of England) "For the

best Silo in England and Wales in actual work during the winter of 1885–86," attracted thirty-seven entries made by thirty-two competitors. The names of the competitors are given below:—

Sir J. D. Astley, Bart., Elsham Hall, Brigg, Lincolnshire.
Messrs. Bateman and Eagle, Brightlingsea, Colchester, Essex.
Messrs. Bayliss, Jones and Bayliss, Astwood, Claines, Worcester.
Ditto ditto.
Lord Belper, Kingston Hall, Keyworth, Nottingham.
Mr. William Body, Wittersham, Kent.
Mr. J. H. Porrer, Angeston, Dursley, Gloucestershire.
Mr. H. A. Brassey, Preston Hall, Aylesford, Kent.
Mr. W. H. Collingwood, Esh Hall, Durham.
Mr. J. F. Cornish, Stancombe, Kingsbridge, Devon.
Earl of Crawford and Balcarres, Haigh Hall, Wigan, Lancashire.
Ditto ditto.
Mr. W. A. Darbishire, Nantlle, Penygroes, R.S.O., Carnarvonshire.
Mr. F. W. Earle, Edenhurst, Huyton, Liverpool.
Mr. J. H. Elwes, Colesborne, Cheltenham.
Ditto ditto.
Mr. A. H. Grant, Abbotswood, Romsey, Hampshire.
Mr. W. J. Harris, Halwill Manor, Highampton, Devonshire.
Mr. W. G. Hellier, Wick St. Lawrence, Weston-super-Mare, Somerset.
Mr. James Howard, Clapham Park, Bedfordshire.
Mr. T. Kirby, Hook Farm, Bromley, Kent.
The Duke of Manchester, K.P., Model Farm, Grafham, St. Neots, Hunts.
Mr. Thomas Martin, Peterville, St. Agnes, Cornwall.
Viscount Midleton, Peper Harow Park, Godalming, Surrey.
Mr. T. H. Miller, Singleton Park, Poulton-le-Fylde, Lancashire.
Mr. C. T. Molyneux-Montgomerie, Garboldisham Manor, East Harling, Norfolk.
Mr. John Morris, Lulham Court, Madley, Herefordshire.
Mr. W. P. Paige, Norton Hall, Ongar, Essex.
Messrs. H. D. and S. D. Pochin, Croft, Leicester.
Mr. Henry Rolfe, Clavering, Newport, Essex.
Mr. Henry Straker, Dipton House, Riding Mill, Hexham, Northumberland.
Mr. Edward Tanner, Clapton Court, Crewkerne, Somerset.
Mr. C. F. Tregplin, Kenilworth, Warwick.
Ditto ditto.
Messrs. Ward and Lawry, Bohetherick, St. Mellion, East Cornwall.
Lord Wolverton, Iwerne Minster, Shaftesbury, Dorset.
Ditto ditto.

There were nine competitors for the Royal Agricultural Society's Prize of 25*l.*, "For the best Stack, or other system for obtaining Silage without a Silo in England and Wales, in actual work during the winter of 1885–86." Their names are given on the next page:—

Mr. Mark Amos, Westbury-on-Trym, Bristol.
The Aylesbury Dairy Company, Stammerham Farm, Horsham.
Mr. Reginald Bell, The Hall, Thirsk, Yorkshire.
Mr. E. T. Blunt, Blaby Hill, Leicester.
Mr. J. J. Carpenter, Barmadon, Bratton Clovelly, Lewdown.
Mr. W. J. Harris, Halwill Manor, Highampton, Devon.
Mr. C. G. Johnson, Oakwood, Croft, Darlington.
Mr. T. Kirby, Hook Farm, Bromley, Kent.
Mr. Richard Osmond, Weston, Lambourn, Berkshire.

The Judges in this competition received their instructions on the 9th of November, 1885, and immediately commenced their inspection of the competing silos and stacks. Most of the competitors were anxious to open their silos without delay, owing to the general scarcity of fodder throughout England in consequence of the dry weather which prevailed in the late summer and early autumn months. To save time and to meet the convenience of the competitors, England and Wales was divided into three sections — the South-Eastern, the South-Western, and the Northern.

The arrangement for inspecting the silos and stacks was as follows:—Mr. Rigby and myself were to visit the South-Eastern Division; Professor Long and Mr. Wheatley took the South-Western, while the Northern Division fell to Mr. Baker and Mr. Fowler. The Judges on again meeting after this first inspection, compared notes, and selected the two or three best entries in each Division for a final examination by Mr. Fowler, Professor Long, and myself. When this last inspection was over, all the Judges met once more to deliver the awards, whereof the particulars appear under the heading of "The Adjudication."

Those who have not obtained full information as to the practice of Ensilage should consult the exhaustive Report on the subject, contributed by Mr. H. M. Jenkins to a recent number of the 'Journal.' * To describe minutely the various silos and stacks in the competition would therefore be out of place, not to say that it would also exceed the province allotted to a Report such as the present one.

II. South Eastern Division. By Tom Parry.

Silos.

The silos and stacks entered for competition in this district were visited by Mr. Rigby and myself, between the 10th of November and 8th of December, 1885. The following paragraphs will show the chief points of interest noticed during the

* Vol XX. Part 1, 1884, p. 126.

visits. The silos are specified below in the order of time as to inspection and not as to merit.

(1) *The Duke of Manchester, K.P., Model Farm, St. Neots.*—This silo is not a new structure, but is an adaptation from a pre-existing building. The dimensions are 24 feet by 19 feet by 22 feet deep—giving a capacity of 10,032 cubic feet, the cost of adaptation being at the rate of 3*s.* per 50 cubic feet, or a total cost of 30*l.* The silage consisted of a mixture of two-thirds tares and one-third oats—grown together. The management of silage-making on this farm was very judicious and successful. The filling would be expensive, but the emptying was convenient and economical. The fodder was pressed by means of bags of gravel upon boards. When opened, both at the top and at the floor level, the silage was found to be of good quality, but of decidedly acid properties. There was not much waste either at the surface or in contact with the walls.

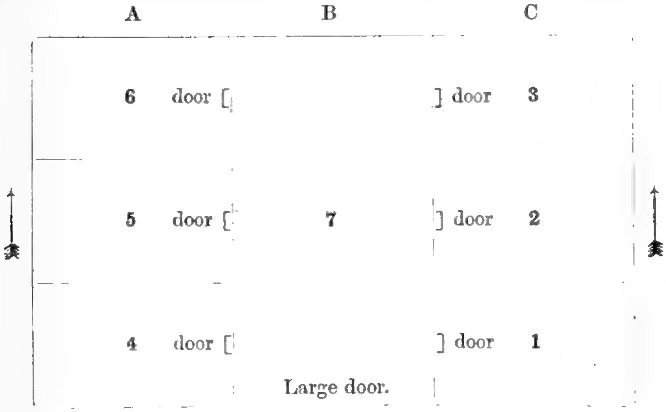
(2) *Mr. James Howard, Clapham Park, Bedford.*—Mr. Howard's silo is a new structure, 12 feet by 12 feet by 17 feet deep. The brickwork cost 42*l.*, and the roof 28*l.*, making the total cost 70*l.* The walls are made of bricks, edge-laid with cement, with a drain at the foundation. No drainage, however, left the silage during the past season. The arrangements for filling and emptying are admirable—the silo being built in the side of a bank. The system of silage-making here differs materially from that adopted by the other competitors. Mr. Howard applies no pressure but that of the fodder's own weight, and that of the men treading, spreading, and ramming the green stuff while the silo is being filled. When required, the roof is made to descend by mechanical means, its four edges entering a small trough, which makes the last course of bricks on the silo walls. The trough is filled with two or three inches of water, thereby forming a hydraulic joint, between the air in the silo and the outside atmosphere. This roof—or lid—costs 35*s.* per square yard of silo surface covered.

The produce of 1¼ acres of maize was cut, carried, chaffed, and ensiled on the 16th and 22nd of September, while on the 17th, 18th, and 21st of September a very light second crop of clover was cut, carried—but not chaffed—and ensiled. The silage would be in three layers, maize at the top and bottom, with clover between. The maize would yield about 15 to 20 tons of green stuff per acre, while the clover in the green state would not average more than 2 tons to the acre. The maize remained in swathe from two to four days; but the clover was ensiled immediately after being cut. The weather was damp during cutting, and fine while carting—excepting the last days of carting maize. Two men and three boys were engaged in spreading, treading, and ramming the fodder in the silo.

Mr. Howard's silo was opened on the 11th of November by the Judges, after having remained closed for 40 days, which is a short period for silage-ripening, if the word may be allowed. The roof was lifted easily by two men working the hauling apparatus. The inner side of the roof was found to be covered with moisture, the result of the condensation of the vapours given off by the fodder undergoing fermentation. The maize silage on the surface was found to be saturated with water for about 6 inches in depth, while at the silo angle appeared a little pipe-like fungoid growth 6 or 8 inches long. The emptying door of the silo was also opened to examine the lowest layers of silage. The clover-silage was excellent in every point, and without any waste even in contact with the bricks used to make the door air-tight. The maize-silage was not so successful. For further particulars as to this system of silage-making, see remarks under "Adjudication" (p. 301).

(3) *Mr. Henry Arthur Brassey, Preston Hall, Aylesford.*—Mr. Brassey's silo is a new structure, consisting of three compartments, each 32 feet long,

12 feet broad, and 10 feet deep, and lying parallel to each other. The two outer compartments are divided each into three smaller divisions, thus :—



There are therefore six small compartments of 12 feet by 10 feet by 10 feet, and a larger one (marked 7) of 32 feet by 12 feet by 10 feet. The roof is made in three sections corresponding in dimensions with the large divisions marked A, B, C; but the roofs over A and C are made so that they may be run off on a little railway in the direction of the arrows, while that over B is fixed. The roofs are made of corrugated iron. The silo is built into the side of a bank, 741 cubic yards of earth having been removed for the purpose. This arrangement secures very advantageous modes of filling and emptying the compartments. The full carts are led up a slight incline, and can deposit their contents *directly* into compartments A and C. The inner compartment is filled by laying boards across the surface of A and C, thereby forming a platform ready to receive the fodder intended for division B. The emptying is begun at the large door in the middle division. If required, the cart can be backed into this compartment to receive silage from either of the divisions marked 1, 2, 3, 4, 5, or 6. The walls are 14 inches thick, and made of brick-rubbish, sand, shingle, and Portland cement. The floors are made of the same materials. The pressures are applied in some compartments by Reynolds's patent, in others by Lister's patent, and lastly by means of concrete blocks, weighing about 1 cwt., made at a cost of 1*s.* 3*d.* each. The whole cost of the silo is made up as under :—

	£	*s.*	*d.*	
Silo	135	9	6	
Weights, mechanical and dead weights	57	6	6	
Roof	200	0	0	= 22*s.* per square yard covered.
	392	16	0	= 35*s.* per 50 cubic ft. of capacity.

The crops ensiled by Mr. Brassey were :—tares, trifolium, green oats, maize, and hopbine. All but the latter were chaffed. The compartments were filled at intervals between the 14th of June and the 7th of October. The details of filling are given on page 264, the crop first named in each compartment being at the bottom, &c. :—

Compartment 1.—Trifolium, oats (Reynolds's chains).
" 2.— " "
" 3.—Oats.
" 4.—Tares, trifolium, oats (screw pressure).
" 5.—Trifolium, oats (concrete blocks).
" 6.—Maize (old iron in boxes).
" 7.—Hopbine, maize (concrete blocks).

The hopbine averaged about 2 tons to the acre, the remaining crops averaging 8 tons of green stuff to the acre.

The Judges witnessed the opening of this silo on the 18th of November, and found the oat-silage in Compartment 1, and trifolium-silage in Compartment 3, to be of excellent quality, and decidedly acid. The tare-silage in Compartment 4, and the oat-silage in Compartment 5, were of fair quality. The maize in Division 7 was very good. The Judges found considerable waste where the maize-silage and hopbine came in contact with the large door, the maize having rotted for over 12 inches of its end section. The hopbine was exceedingly hot and dry underneath the maize, which no doubt aggravated the waste noticed. There was less waste in those compartments where dead weights were used, both on the surface and at the sides, than where the mechanical pressures were applied.

(4) *Mr. William Body, Wittersham, Kent.*—This silo is a new structure, 18 feet 9 inches by 17 feet 3 inches by 8 feet 9 inches. It is entirely under the ground-level, the soil being sandy loam. The floor is made of 6-inch concrete, with a thin coat of cement. The walls, or sides, are made of creosoted timber, with no lining. A drain was put at the foundation, to carry off any moisture. The silo is divided into four compartments. The roof is made of larch-fir posts, deal timber, and corrugated iron. The total cost of the silo, roof, and mechanical pressure was 37*l.* 8*s.*, or a little above 13*s.* per 50 cubic feet of capacity. The crops ensiled were rough meadow-grass, with a little trifolium and trefoil, which were all pitted in fine weather. There was the usual amount of waste and mouldiness.

(5) *Mr. T. Kirby, Hook Farm, Bromley.*—This silo is a new structure, 14 feet of the depth being under the level of the ground and 6 feet above. The dimensions are 44 feet by 270 feet by 20 feet, at a total cost of 200*l.*, or about 9*s.* per 50 cubic feet of capacity. The whole building is most substantially constructed, the walls being 14 inches thick, with a division wall 25 inches, making two compartments. The roof is made of timber and slate. The sides of the walls are lined with cement, and made exceedingly smooth. The chief filling is done through a door in the side-wall at the ground-level. When the fodder rises inside the silo above the ground-level, the green grass is then elevated through a large opening in the gable ends. The floor of the silo is formed by the gravel which underlies the clay in this part of the country; but when examined the second time, the silage at the bottom was not dry—proving that there was no *outlet* for the moisture at that time. The pressing is most effectively and economically done with about a foot deep of soil over the whole surface,—the pressure last year being estimated at about 70 lbs. per square foot. The only precaution taken to protect the grass from contact with the soil is the placing of boards round the edges of the fodder for about two or three feet. It was surprising what little waste there was, either on the surface or at the sides.

The cutting of very good meadow grass was begun during the second and third week of June. The carts followed the mowing machines, but the grass was not chaffed last season. The produce of 140 acres was cut, carried, and

ensiled in about sixteen days—the old system of making the crop into hay taking about five weeks. The fodder was constantly trodden by men and horses, and the sides were thoroughly rammed down.

The cost of attendance per cow per week is only 1*s*. This is secured by hiring a cow-man with grown-up boys and girls. He has 56*s*. per week for attending to 56 cows. If he cannot command sufficient labour from his own family, he must hire. This payment includes such items as milking and cleaning the cows, and also the preparation of the food, as slicing mangolds, and mixing the grains, meals, and silage with the roots. They have not to carry the foods for long distances. The manure from the byres is taken in a wheelbarrow up a platform, where it is emptied directly into a dung cart and carried off to the fields without delay. This excellent arrangement secures kind and quiet treatment for the cows, and profit for the master. To judge by the general appearance of the men, the management enables them to live comfortably also. The practice of ensilage on this farm is made to supply the main fodder for milk-production. The ration on the 18th of November, 1885, consisted of the following mixture:—

	Dry Substance.	Digestible Nitrogenous.	Digestible Carbo-hydrates.	Fat.
	lbs.	lbs.	lbs.	lbs.
4 lbs. bran, costing 2*d*., containing ..	3·5	·49	1·5	·14
2 lbs. oat husks 0½*d*. ,, ..	1·75	·03	·73	·012
1 lb. hay chaff 0½*d*. ,, ..	·83	·074	·42	·001
2 lbs. rice meal 0¾*d*. ,, ..	1·78	·18	·788	·17
12 lbs. brewers' grs. 1*d*. ,, ..	2·9	·468	1·14	·048
44 lbs. mangolds 3¾*d*. ,, ..	5·28	·484	4·004	·044
26 lbs. silage 3½*d*. ,, ..	6·5	·462	3·822	·042
(estimated to equal 42 lbs. of mangolds) 12*d*.	22·54	2·188	12·404	·451
Required for sustenance of 1000 lbs. live weight	..	·7	8·	·15
		1·49	4·404	·301
Required for production of 20 lbs. milk the daily average per stall	..	·8	·92	·74
Excess (+) or deficiency (−) in food		·69 (+)	3·48 (+)	·44 (−)

From the analysis given above of Mr. Kirby's ration for milk-production, it is seen at once to contain an excess of digestible nitrogenous substance, as well as of digestible carbo-hydrates. But if good milk contains, as Warington states, 3·7 per cent. of fat, Mr. Kirby's ration is seriously deficient in this constituent, having a smaller quantity by ·44 lb. per day, even for the production of one-fifth part of 100 lbs. of milk. It will be seen that the 26 lbs. of silage is estimated to contain as much nutriment as 42 lbs. of mangolds. This is calculated from the results obtained at Rothamsted from silage containing about 75 per cent. of water. On the principle that the nourishing value of 10 lbs. of dry substance in mangolds is equivalent to that of 12 lbs. of dry substance in silage, Mr. Kirby's ration of 26 lbs. of silage may equal 54 lbs. of mangolds instead of 42 lbs. as by the above estimate. But the fat would still be inadequately provided for by this allowance.

The Judges witnessed the opening of this silo on the 18th of November,

after it had been closed for a period of 147 days. The quality of the silage was very good, and there was very little waste.

(6) *Mr. William Pering Paige, Norton Hall, Ongar.*—This silo is an adaptation of a straw barn, the only expenditure having been 10*s.* for the erection of a door in one of the gable ends, the old door at the side being boarded up. The dimensions are 35 feet by 24 feet by 17 feet. The whole silo is above the ground level, the fodder being pressed by the weight of old tram-car wheels. Mr. Paige's silo was opened on the 19th of November, when the bulk of the fodder was of good quality. The silage, through some cause, had subsided very irregularly, and there was much waste, especially opposite the old door that had been boarded up.

(7) *Mr. Arthur Henry Grant, Abbotswood, Romsey, Hants.*—Mr. Fraser, the Manager of the Society's Experimental Farm at Crawley, near Woburn, at the request of the Council, witnessed the opening of this silo. His report is as follows:—

"This silo is entirely underground, and measures 16 feet by 14 feet 3 inches by 12 feet deep; it is covered by a rough shed, roofed with Willesden paper, which is used for storing straw and roots, &c., under. The walls are built of bricks, 9 in. work for 3 feet from the bottom, then 4½ to the top. The bottom is also of bricks, but they are laid on edges and slightly dished, and the whole is thinly coated over with cement. The silo is provided with a hole at the bottom to collect the drainage, but there is no outlet whatever. Estimating the weight of silage at 56 lbs. per cubic foot, it is capable of containing rather over 68 tons. Both gravel and sand were excavated when making the silo, and from a portion of the former Mr. Grant made some concrete blocks for weights. The blocks are rectangular, and during filling, when the silo is full, by placing these blocks on the walls to a height of 4 feet or more, Mr. Grant is enabled to fill the pit to that depth, which allows greatly for shrinkage.

"The total cost of the silo was 26*l.* 3*s.* 6*d.*, and of the shed 10*l.* 8*s.* 9*d.*, but the latter is also used as a Dutch barn. The cost of filling and weighting the silo was 4*l.* 5*s.* 5*d.*

"The silo was filled on June 13th with rye-grass and meadow-grass, the carts being backed up to the edge and tipped up. Special care was taken to tread the grass well round the sides and in the corners, there being always two or three men in the silo for this purpose. It was weighted the same day with concrete blocks resting on boards. On Monday, the 15th inst., the grass having sunk considerably, the silo was opened and refilled, the last four loads being rough grass from an orchard, and on the top of this a few forksful of straw were thrown about. The boards, consisting chiefly of rough slabs, were then placed on, and the whole again weighted with the concrete blocks. More weight was applied to the sides than the centre.

"The silo was opened in my presence at about one o'clock on Thursday, October 15th. On the weights, &c., being removed, I found that the first 4 inches below the surface were black and sodden in appearance, and for 3½ inches below this the silage was mouldy, after which it was quite good. It was of a light colour, and had a strong acid smell, but was decidedly a good sample of sour silage. At a depth of 2 feet from the surface, about 3 feet from the side wall, the silage was perfectly free from mould, and would doubtless be so down to the bottom of the silo. Six inches from the side wall there were 3 inches of black sodden stuff on the surface, and 2 inches below this was mouldy, after which the silage was quite free from mould. At a depth of 8 inches from the surface, the mould penetrated 4 inches inwards from the side wall, whereas 2 inches below this there were but 2 inches of mould; and as we cut deeper into the silage, the mould gradually decreased until at 2 feet from the surface it was quite good close up to the wall.

"On removing the silage from the corner, I found that at a depth of 9 inches

the mould penetrated 6 inches inwards (from the corner), and at a depth of 2 feet, 2 inches inwards. Probably there would be an inch or two of mould the whole way down.

"FRANCIS E. FRASER.

"*October 30th*, 1885."

It is not necessary to add anything to Mr. Fraser's report of the silo and its contents, but the Judges cannot help mentioning the beautiful make of butter on this farm from very acid silage. The taste, texture, and colour of the butter were all alike excellent, showing most careful management on the part of Mr. Grant and his subordinates.

(8) *Mr. Henry Rolfe, Cladering, Newport, Essex.*—This silo is a new structure, built after the plan of Mons. Goffart. It is divided into two compartments with rounded angles, each measuring 31 feet 6 inches by 14 feet by 23 feet. The walls are made of concrete, 10 inches thick, lined on the inside with cement. The roof is set on 6-inch posts, 5 feet above the wall, formed of 7 in. by 4 in. deal plates, 4½ in. by 3 in. purloins, 4½ in. by 3 in. rafters, and corrugated iron sheets. The roof cost 54*l.*, or about 11*s.* per square yard covered, while the silo cost 118*l.*, although the whole cost is not high. The filling here is expensive, but the emptying is done economically. Mr. Rolfe's silo was opened on the 23rd of November; the silage was of good qaality, but decidedly acid. There was considerable waste on the surface through mouldiness. The fodder was weighted by bricks.

(9) *Messrs. Bateman and Eagle, Brightlingsea, Colchester.*—This silo was examined on the 24th of November. The Judges regret to say that one of the silo walls had given way under the great weight of the maize silage. This accident modifies its position in the competition. In other respects the Judges were exceedingly pleased with the silage-making at this farm.

(10) *Viscount Midleton, Peper Harow Park, Godalming.*—This silo is an adaptation of one wing of an old barn by running a brick wall across, thereby securing storage capacity (20 feet by 12 feet by 10 feet) of 2400 cubic feet, at a total cost, including pressing apparatus, of 24*l.* 10*s.*, or a little above 10*s.* per 50 cubic feet of capacity. This is costly. The pressing is done by a movable lid equal in size to the surface of the silo. Its movements are directed by means of two screws. In action the arrangements appeared to be cumbrous and laborious, and inconvenient for the purposes of emptying the contents. It is also questionable policy to release all the surface-pressure, when only a small section of the silage is required. The silo was drained into a small tank, holding about 19 gallons. The silo was filled with unchaffed-rye (in ear), trifolium, river-side grass, and trimmings off the sides in the woods.

The silage examined on the 25th of November was found to possess very decided smell and acidity, with considerable waste at the surface and sides.

(11) *Mr. Cecil T. Molyneux-Montgomerie, Garboldisham Manor, East Harling, Norfolk.*—This is a new structure, and in form somewhat resembling Mr. Brassey's silo. It consists of three parallel compartments of a total capacity of 30,231 cubic feet, and erected at a total cost of 545*l.*, or a little above 18*s.* per 50 cubic feet. The outer compartments have been subdivided each into three chambers of the capacity of 3231 cubic feet. The inner compartment has been subdivided into four chambers, on account of the great lateral pressure of the maize-silage. The whole silo is very substantially built. The roof is made of timber and Willesden paper. The whole arrangements are well designed to economise labour, with the exception of the filling. But Mr. Molyneux-Montgomerie hopes to be able to distribute his fodder amongst the different compartments by means of the French machine, described in the Report of Mr. H. M. Jenkins on the "Practice of

Ensilage at Home and Abroad." The walls and floors are lined with cement, and the structure is altogether a commodious and handsome silo.

The Judges examined the two compartments containing silage on the 8th of December. The maize had been cut in the milky stage, chaffed, and pressed by Reynolds's patent. At 7 inches from the surface the silage gave an acid reaction. When offered to two Shorthorn-cows it was refused, at least while we remained in the yard. The amount of waste at the surface and sides was under the average.

Silage Stacks.

(1) *The Aylesbury Dairy Company, Stammerham Farm, Horsham.*—This silage stack was examined by the Judges on the 14th of November. It was built like an ordinary rick of hay, and then pressed by Mr. C. G. Johnson's patent, which has been illustrated and fully described in the 'Journal' (Vol. xxi., Part II., 1885, p. 729). The crop consisted of two-thirds trifolium, and one-third Italian rye-grass; one half of the field being sown with "early" trifolium, and the other half with a "later" variety. The crop was cut in full bloom, and stacked in a corner of the field it grew on. The roof of the stack was finished or "peaked" with rough straw, as Mr. Allender did not care to risk more valuable fodder in his first attempt to make stack-silage. The early variety was cut and carried on the 12th and 13th of June. The later variety was cut and carried on the 22nd, 23rd, and part of the 26th of June. The mechanical pressure had been applied to the stack in the intervals of cutting, and was calculated to exert a force of $1\frac{1}{4}$ cwt. on the square foot. The silage throughout was excellent in quality, the upper layers being sweet, while the lower layers were acid. The silage was readily eaten by the cattle, and when chaffed with oat-straw gave out a deliciously fragrant odour, most appetising in its effects. The dimensions of the silage stack proper at the last inspection were 17 feet by 18 feet by $7\frac{3}{4}$ feet, which quantity of material should weigh about 50 tons. The crop in its natural state was estimated to weigh 70 tons. If these data can be relied on, it would appear that the change and loss in the stack amounts to about 30 per cent., which is a little more than was found in one silo at Rothamsted. The cost of making was given at 2*l.* 2*s.* per acre (about 7*s.* per ton of silage), made up as under:—

	£	s.		s.	d.	
Cutting	3	0	=	7	6	per acre.
Loading, carting, delivery	4	12	=	11	6	"
Making stack, treading	3	0	=	7	6	"
Labour in weighting	5	0	=	12	6	"
Interest on capital expended on appliance	2	0	=	3	0	"
				42	0	"

(2) *Mr. Richard Osmond, Weston, Lambourn, Berks.*—This stack was made up of a mixture of sedge, coarse grass from the river side, and some rough meadow-grass. The whole had been pressed by Messrs. Amos and Hunt's chains and levers. The stack had the appearance of a small hayrick. It was put together about the end of July,—25 cwts. of salt having been sprinkled on the outside portions, and the the total cost was 31*l.* 9*s.* When the stack was examined and cut into, on the 19th of November, the whole appeared spoilt, the inside portions being dark in colour, and possessing an overpowering smell! But the Judges would not have put any value on the stuff for feeding purposes even in its green state.

(3) *Mr. T. Kirby, Hook Farm, Bromley.*—This entry consisted of meadow-grass of good quality placed in an old gravel pit, thoroughly trodden,

and covered over with gravel and soil. It is sufficient to say that the silage was of good quality, and with very little waste. But it could hardly be called a silage stack.

III.—The South and South-West of England. By Prof. James Long, of Graveley Manor, Stevenage.

It having been arranged at the meeting of Judges at Hanover Square that the West and South-West of England should be allotted to Mr. John Wheatley and myself, we commenced our inspection on the 11th of November by visiting the farm of Colonel Stallard, at Claines, near Worcester, on which were two silos entered for competition by Messrs. Bayliss, Jones, and Bayliss, of Victoria Works, Wolverhampton. I may observe, in the commencement of my Report, that my colleague and myself began our duties with the assumption that the chief aim of the silo is to make or preserve a maximum amount of silage at a minimum cost; that to this end it should be simple and effective in its arrangement, and economical in its working and construction; that the system of pressure adopted should neither be complicated nor costly; and that, as far as possible, a silo should be a building, or part of a building, adaptable to other purposes of the farm, and not a mere receptacle for fodder, which, in those years when silage is not made, would be of no practical use whatever. It will be seen by the Report that each of the silos placed in the highest position combined these qualifications, more especially those of Mr. John Morris and Mr. W. J. Harris, and that, although the silos of Messrs. Kirby and Trepplin are covered with earth, an eminently satisfactory plan, the pressing arrangements adopted by the two first-named gentlemen are home-made and simple in the extreme, which cannot be said of some of the other systems of mechanical pressure referred to in this Report.

Silos.

Messrs. Bayliss, Jones, and Bayliss's Silo.—Messrs. Bayliss, Jones, and Bayliss, as already stated, entered two silos for competition. No. 1 was 16 feet by 10 feet 8 inches, by 10 feet in height. It is described as a "Patent Convertible Iron Silo," the sides being composed of galvanised iron sheets, secured to Tee-iron uprights. The iron sheets were 10 feet deep, by 2 feet wide, and wedged in to the Tee-iron with tow, in order to make the silo air- and water-tight. There was no projection in the interior of the walls to cause resistance in the operation of treading or shrinking of the silage, and the corners were satisfactorily rounded. To give further strength to the walls, iron ribs were threaded through the uprights every 14 inches, and steel angle-bars were wedged vertically between these horizontal ribs and the galvanised sheets, thus binding the whole fabric together, and—the maker's claim in addition—making it a "very rigid and firm structure." This, however, is what it certainly is not, for the walls bulged, and the whole erection was shaken when

the pressure-beams were lifted at either end. The roof of the silo is of curved corrugated iron, fixed upon an iron frame-work, and arranged so that it can be lowered or raised at will. For this purpose chains are provided and fitted with hooks. Upon these, one or two of the weights, provided for the pressing apparatus, are hung for balancing, and the roof can thus be raised by one man. This, however, did not prove a success, for it was only raised by two men with considerable difficulty. It is, nevertheless, fair to add that the work was performed by the men upon Colonel Stallard's farm, in the absence of representatives from Messrs. Bayliss, Jones, and Bayliss; but, at the same time, it would be necessary in practice for the farm labourers to conduct this work themselves, and not to rely upon the assistance of skilled mechanics. Within the silo, which was filled with coarse unchaffed grass, were planks 7 inches by 2 inches, and reaching the whole length of the silo. These were, unfortunately, very much lower at the sides than in the middle, the sides evidently having been imperfectly trodden. The consequence of this was that the whole pressure applied was concentrated upon the centre, and that the sides, being practically unpressed, were very much spoiled, and in many places attacked by fungi. The surface of the silage was spoiled only to a slight depth, the pressure being effectual where it was felt. The pressure is exerted upon two wooden beams running across the silo. At each end is a pulley-wheel working in a groove, and over this runs a chain attached to a cast-iron base fixed in the ground. Upon the end of this chain, after passing over the pulley, a number of cast-iron 56 lb. weights are hung, and the pressure is severe in accordance with their number. This system undoubtedly provides continuous pressure, but, like other mechanical systems, it does not adapt itself to the unevenness in the surface of the silage. It is claimed that by means of 10 cwt. attached to the end of each beam the pressure on each end is actually four tons, so that a pressure of 112 lbs. is exerted upon every square foot. This pressure can be diminished or increased at will, by the use of a smaller or a larger number of weights. The silo is entered from one end by the removal of one of the galvanised sheets. The floor is of concrete, and the makers state that the silo itself can be adapted for any other purpose by fixing the pressure-beams in the slides upside down, and placing the covering-boards upon them, converting them into a floor. The cost of the silo, without the roof, is 25*l.* 10*s.*, and that for the removal of earth and the construction of a 9-inch concrete floor, 2*l.* 19*s.* 2*d.*, whereas the galvanised iron roof is priced at 8*l.* 10*s.* The charge for the apparatus for continuous pressure, including the covering-boards, was 26*l.* 17*s.* 6*d.*; so that in all, the silo, with an estimated capacity of thirty-five tons, is priced at the large sum of 63*l.* 16*s.* 8*d.* The principal defects appeared to us to be excessive cost, trouble in fixing—this applying equally to the weighting apparatus and the roof—and the unevenness of the pressure, entailing considerable loss around the sides.

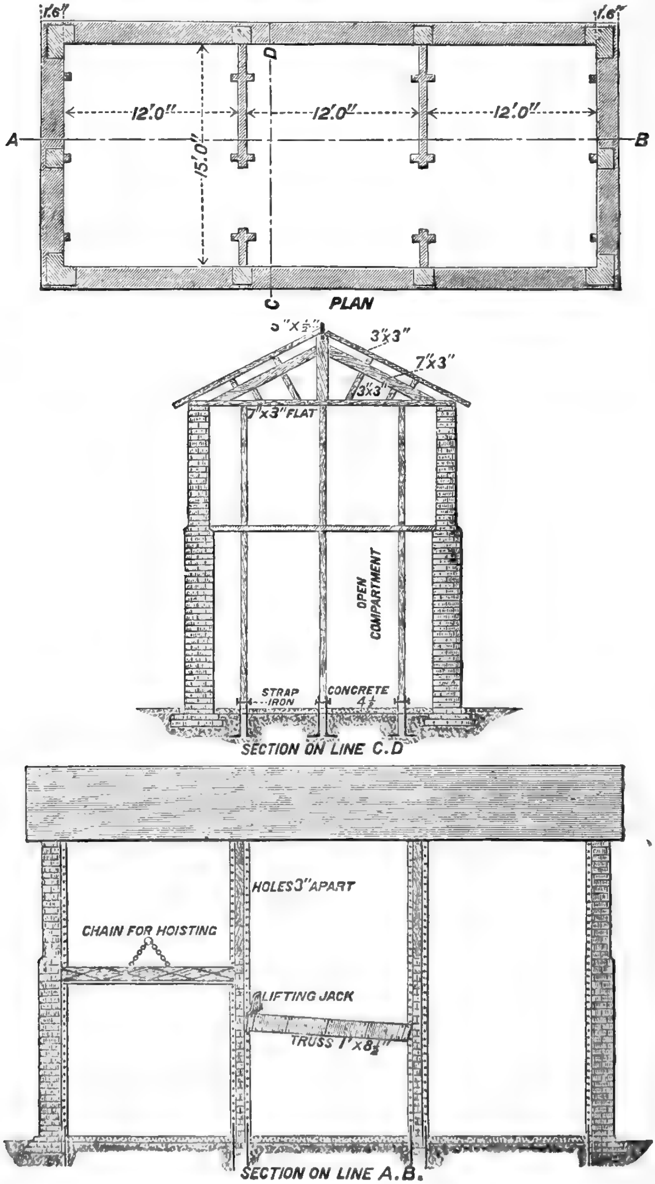
The second silo entered by Messrs. Bayliss, Jones, and Bayliss was upon the same farm, and was filled with chopped maize in the middle of September. When the silo was filled, the crop reached a height of 8 feet, but when opened in the presence of the Judges, it was only 4 feet in depth, and was covered with a small quantity of rough grass, which was spoiled. For the purposes of examination the galvanised-iron door at the end was removed, when it was found that the maize lying directly against the iron was particularly bright in colour, although the remainder was dark, and that near the sides partially decomposed. The great bulk, however, beneath the surface, although exceptionally strong in smell, was quite sweet to the taste. The temperature of the interior was 85 degrees, and as it was reached, the smell became more wholesome, resembling, moreover, that which I had seen in the maize silos of M. Goffart and others. The top crust, however, was apparently quite spoiled, whether judged by its appearance or smell; but after careful examina-

tion we believed that it would be almost all consumable. The maize was drilled after vetches, and a portion of the crop averaged twenty-five tons per acre. It was chaffed and well trodden by one man, the pressing-boards being subsequently covered with hay-chaff, which was ineffectual in excluding the air. The weights used in pressing this silage were $10\frac{1}{2}$ cwt. on each chain, and this was sufficient to express the water from the maize, which oozed out at the points of the silo.

Mr. Morris's Silo.—The next silo inspected was that at Lulham Court Farm, Madley, the property of Mr. John Morris, of Hereford, which was awarded the prize. It is an entirely new structure, 36 feet in length, 15 feet in width, and 13 feet in height, with a super-silo or shed above, 7 feet in height, to the eaves of the roof. The silo may be described as an underground silo, walled in stone, and excavated 10 feet deep, the surrounding ground being banked up 3 feet to the top. On the coping are built ten brick piers, 7 feet in height, and upon these the roof is supported. The silo itself is divided by two cross walls into three compartments, each 15 feet by 12 feet, by 15 feet. In these walls are planked openings, affording ready communication from one compartment to the other. There is a third opening in the front wall of the middle compartment, which is approached from the farmyard by a walled sloping road, wide enough for a cart or a trolley to pass along. The portion of this road immediately contiguous to the wall of the silo, being beneath the surface of the ground, is covered with a brick arch, and when the silo is ready to fill, the door at the end is hermetically sealed up by close-fitting planks. This sloping road provides a most complete and convenient method for emptying the contents of each compartment of the silo. In the work of excavation, 320 yards of earth were removed, at a cost of 4*l.* The walls of the silo, as well as the adjacent earth-supporting walls and arch, are built of stone raised upon the estate; but the coping, together with the arch and the divisional walls, are of brick and timber. The lower half of the stone walls is 20 inches in thickness, this declining to 18 inches in the upper half. The divisional walls are $4\frac{1}{2}$ inches thick, and the brick piers 14 inches square. The inside walls are lined with the best London cement, mixed with sharp river-sand, in the proportion of one to three. The floors are of lime-concrete, from 5 to 6 inches thick, and composed of picked stone from the fields, chippings, river-sand, and common lime. There is a 3-inch drain-pipe placed outside the foundation completely round the silo. This delivers on lower ground 35 yards away, but has no communication with the interior of the silo. The roof is deal, and covered with red Bridgewater tiles. It is also supplied with an iron-gutter and down-pipe, both of which are painted. The position of the building is exceedingly well arranged, as it is within 70 yards of six cattle-folds, where Mr. Morris's well-known herd of Herefords is principally wintered. There are several other cattle-sheds and cart-horse stables similarly contiguous. In the angles at each side of the brick piers are triangular pieces of timber, painted black, with their exposed edges scolloped. This feature, and the Bridgewater tiles, give an agreeable appearance to the building, which is only equalled by its usefulness. In Mr. Morris's words, the weighing or pressing is derived from a common lifting jack, "used for farm purposes, bearing on wooden trussels, three of which are placed in each division of the silo. These move up and down on firmly fixed wooden guides, bored at intervals of 3 inches, and having iron-lining plates, corresponding with the borings in the wood. They admit of being pinned down when sufficient pressure is obtained by the aid of the jack. The resisting power of the trussels is augmented by cross-pieces inserted within them, all being securely fastened and banded together by oak-pins, iron-nuts, and bolts, and strap-iron." These weighting-beams are composed of three 12-inch by $2\frac{1}{4}$-inch planks, united by 3-inch pieces between them, the whole being bound

together as described above. Each beam is fixed into the pierced uprights, so that when a ½-inch steel bolt is run through the holes of the upright, its two ends rest upon the two ends of the beam, and prevent it rising. When it

Figs. 1–3.—*Plan and Sections of Mr. Morris's Silo.*

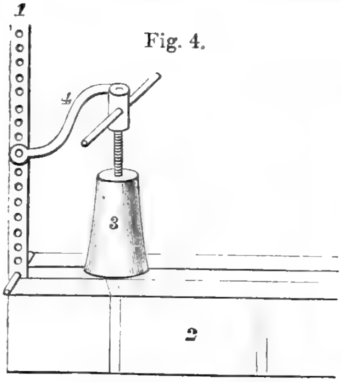


is necessary to press the beam down, a second bolt is placed through the holes in the upright 18 to 20 inches above, and by means of an iron arm, one end of which is attached to it, and the other to the top of the screw-jack, a sufficient purchase is obtained to enable the jack to work. When the beam has been sufficiently screwed down, it is fixed into its place by passing another bolt through the upright, and the jack is removed to the other side, which is screwed down in the same way. The planks used beneath the pressure-beams are 12 inches by $2\frac{1}{4}$ inches. When the silo is opened, the beams are run up overhead, and fixed by the bolts as when under pressure, and are quite out of the way. The covering-planks in the centre of each division of the silo are cut in half, exactly under the centre-pressure beam, enabling the men to cut out silage without uncovering more than a small portion. Mr. Morris designed a simple system of continuous pressure, which was shown to us, but was not in use, as it was not found necessary. This was in the form of an ash-lever, fixed in each end of the pressure-beam, with a fulcrum beneath. Upon the other end was a ring for the suspension of weights. Curiously enough, this system is similar to that adopted by Mr. Christopher Wilson, of Rigmaden Park, who presses his silo in a like manner to Mr. Morris, using, however, a hydraulic jack instead of a screw-jack. The back of the super-silo and one end are boarded in between the brick-pillars, and as, when not in use, the covering planks can be laid across the pressure-beams at any height, it is quite evident that a covered apartment, with a sound dry floor, can be provided for almost any purpose—for storing hay, straw, or roots, mixing food, sheltering implements, or, as Mr. Morris jocularly remarked, for dancing, when either of his young people get married. The silos beneath, too, being so easily approached from the sloping road, can be used for storing any kind of farm material or produce, or even converted into compartments for stock. The arrangements outside the silo are equally practical, for, although it is an excavation, it appears to stand upon a bank, which, however, has been artificially made, and which is considerably higher than the yard in which it stands. There is, nevertheless, a sensible object in this, for, when the carts of fodder arrive, they gradually ascend the bank at one end (and it should be mentioned that it is railed all round), deliver their contents, and descend down the slope at the other end, passing over the arched road beneath. When the silo is being filled with chaffed silage, and the engine is placed at the entrance to this sloping road, the driving-bands are carried to a pulley, fixed upon a shaft under the arch to the right, while a pulley on the same shaft to the left draws a large silage-chaffcutter standing above by the side of the silo. A more complete arrangement than this we have never seen, for it enables the men to fill with the utmost speed, and, as platforms are easily made by means of the trusses and planks placed at any height, the chaff is delivered into either compartment at will.

In two divisions of the silo were green oats and grass, the latter being at the top, while in the third division was a second crop of rye-grass and clover. Two days were required to fill each compartment, and each contained about 25 tons. The temperature 7 feet below the surface of the centre was 90 degrees. Upon removing the covering boards the clover and rye-grass (which was cut wet) were found to be very perfect, although at the top there was a small quantity of white mould. The sides, however, were not so good, waste extending from 3 to 4 inches, and still more at the corners, which would have been better if rounded, and which were evidently not sufficiently trodden. The temperature of the grass was 88 degrees. When cut, it was ripe and dry, but of only moderate quality, containing a quantity of *Holcus lanatus*. In colour it was a lightish yellow, but, like the clover, smelt sweet and rich. The oats were about 4 feet in the straw and in ear. They also smelt most agreeable and tasted sweet. The treading is per-

Figs. 4–9.—*Details illustrating Mr. Morris's Silo.*

Fig. 4.



1. Iron column, with bolt-holes.
2. Pressure-beam.
3. Jack. 4. Iron arm.

Fig. 5.

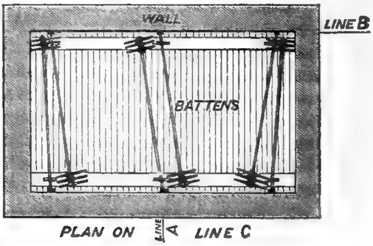
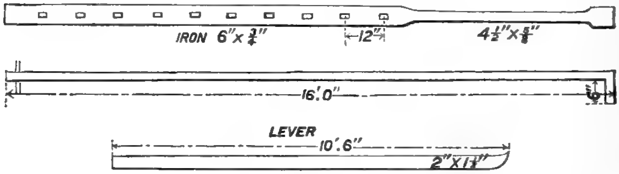
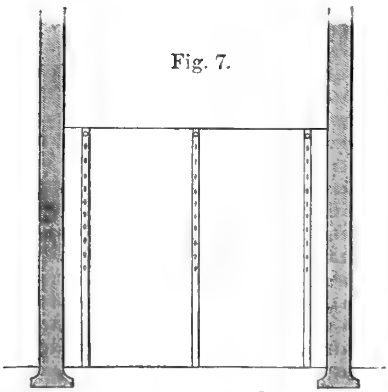


Fig. 6.—Iron Column and Lever.



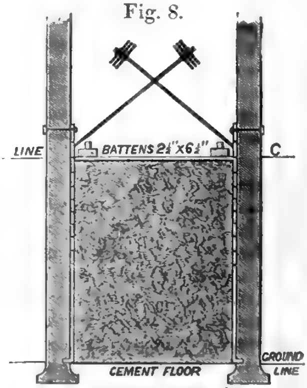
Weight for Lever 7 st. 4 lbs. without wheels.

Fig. 7.



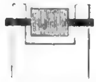
SECTION ON LINE B.

Fig. 8.



SECTION ON LINE A.

Fig. 9.



Pressure-beam (iron column shaded, and bolt black).

formed by a horse which continues to tread until, as Mr. Morris remarked, he walks himself out at the top. Upon our second visit in January, the middle of the silo had been partially emptied, having been cut from the top to the floor, and the right-hand compartment was cut half through. The silage was then found to be exceptionally good in appearance, but further examination showed that the corners and sides were still unsatisfactory, although this failing could not be attributed to any fault of the silo itself, but rather to the labourers who had filled it. This point cannot be too clearly insisted upon, for it is manifestly impossible for any building, however perfect it may be, to do its work unless those responsible for the filling and treading do theirs. In one point it seems clear that an improvement might be made, and this I believe Mr. Morris fully understands. Directly the cubic space of a silo is minimised, the proportion of loss is increased, and therefore it is evident that every silo should be as large as possible, so that the superficial area should be decreased *pro ratâ*. Suppose, for example, two silos are made, each 9 feet by 9 feet by 4 feet, which would give a cubic contents of 324 feet; but suppose also that one of these is divided into six compartments, each 3 feet by 3 feet by 4 feet. As it is frequently found that the silage is destroyed for 3 inches from the walls, and indeed from the top and bottom, it may be assumed for the purpose of the argument that in each case this quantity of silage is destroyed. It is obvious, therefore, that while in the single silo the loss would be 76½ square feet, the loss in the six small ones would amount to 127½ square feet, or nearly 75 per cent. more. The cost of the Madley silo was as follows:—

	£	*s.*	*d.*
Timber for roof 142 cubic feet } 300 feet at 11*d.* ..	13	15	0
„ „ weighting 158 „ }			
„ „ rafters 40 „ at 8½*d.*	1	9	2
Bricks, pipes, oak, red deals, &c., with extra sawing ..	12	6	2
Ironmongery, nails, screws, smith's work, &c.	8	0	0
Lime	3	15	0
Quarry stone, 120 yards at 8*d.* and cider	4	10	0
Excavating	4	0	0
Masons and labourers	25	0	0
Carpenter	8	10	0
Cement, 7 barrels at 11*s.* 6*d.*	4	0	6
Hauling materials	12	15	6
Tiles and cress	4	17	4
Total	£102	18	8

Mr. Elwes's Silos.—The next silos inspected were those of Mr. J. H. Elwes, of Colesborne, Cheltenham, two of which had been entered for competition. These were of a most practical kind, especially suitable for imitation upon homesteads where the same convenience is at hand. The first silo, situated at Rapsgate farm, upon the Cotswold Hills, where thousands of acres are out of cultivation, is an adaptation of one end of an old barn. Its length is 20 feet 8 in., its width 13 feet 6 inches, and height 12 feet. The bay of the barn is walled up with stone from an old wall, and the provision for emptying is a door 6 feet 3 inches, by 3 feet 6 inches, which "hatches against the jambs upon the inside." The total cost of the silo was 15*l.* 9*s.* 6*d.* The portion spent in clearing the floor and levelling the foundations of the wall was 15*s.* 4*d.* The walls are 16 inches thick, costing 5*l.* 6*s.* 3*d.*, and were lined with Portland cement one part, and sharp sand three parts, at a cost of 4*l.* 17*s.* 10*d.*, the work costing roughly, according to the estimate prepared by Mr. Elwes, 6*d.* per yard for 90 square yards. No drains are used. The floor, which is of hard earth,

is below the ordinary floor in the barn, earth having been dug out, at a cost of 7*s.* 6*d.*, as deep as was considered safe—about 3 feet. This silo was weighted with 10 tons of very hard stone laid upon covering planks 2 feet thick by 11 inches wide, which cost 3*l.* 10*s.* 2*d.* The cubic measurement of the silo being 3348 feet, it was estimated that allowing 56 lbs. per square foot, it would hold 82 tons if full; but in this instance it was not full, nor, considering that silage necessarily sinks, can it be filled to the top without some provision in the form of temporary walls to keep the crop together above the top. The crop in this silo was a first cut of cow-grass taken from 10 acres, the yield having been exceptionally good. It was chaffed, and produced silage of first-rate quality. Examination was made in different parts of the silo, and the waste was found to be chiefly upon the surface and at the sides and corners; but this was not large, and the experiment may be regarded as a distinct success. The crop was mown in a day and a half, at a cost of 12*s.* Carting and delivery costing 3*l.* 6*s.* 6*d.*, chaffing 3*l.* 0*s.* 7*d.*, and filling and treading 2*l.* 1*s.* 6*d.* These sums, with the cost of weighting, amounted to 9*s.* 10*s.* 1*d.*, or, estimating the silo to have contained 60 tons, 3*s.* 2*d.* per ton, or 19*s.* an acre; but, as the yield was a large one, there can be no doubt that the quantity was more than that estimated. The door referred to above is at one side of the silo and level with the barn floor: it is boarded up, the joints being keyed with iron. The mixing floor being in the same barn as the silo, it was found that the system of chaffing was most convenient, the silage being simply cut out and at once mixed with chaff and other foods. The chief failings, however, in a silo of this kind are, first, the difficulty in elevating, and, secondly, the trouble of removing so large a quantity of stones.

The silo at the Penhill Farm is built in a barn upon the same principle as the above, but in this instance the door opened into the chaff-house at the side, and not directly into the barn. It is 19 feet 5 inches in length, 18 feet 3 inches in width, and 14 feet 6 inches inside height. The total cost was 18*l.* 9*s.* 1½*d.*, including the door and covering-boards, 3*l.* 12*s.* The walls, 18 inches thick, are supported by a buttress 18 inches wide, carried up the middle of the wall, within 4½ feet of the top. The erection of these cost 6*l.* 10*s.* 8½*d.* The inside plastering with Portland cement and sharp river sand, as before, cost 7*l.* 11*s.* 1*d.* The covering-boards in one corner are cut short, so that too large a proportion of silage is not disturbed at one time. The corners of the silo are square. In the process of filling, the chaff was elevated to a stage some 6 feet high, and then thrown into the silo, a process admittedly somewhat troublesome. The crop preserved in the silo was composed of sainfoin mixed with cocksfoot and dogstail grasses, all chaffed. It consisted of twenty acres of a two year's ley, and was mown at a cost of 2*s.* 6*d.* an acre. In carting and delivering, four horses were employed, at 3*s.* a day, two carters at 2*s.*, two women at 1*s.*, and three boys at 6*d.*, amounting in all to 19*s.* 6*d.* a day for six days. Chaffing cost 4*l.* 14*s.* 6*d.*, divided as follows:—Engine, 4*s.* a day, chaffcutter, 2*s.*, driver, 1*s.* 6*d.*, treader, 2*s.* 2*d.*, unloader, 1*s.* 10*d.*, coal, 4*s.*, oil, 3*d.*—or 15*s.* 9*d.* per day for six days. Filling the silo cost 2*l.* 17*s.*, including five men for six days, and one horse three days. This, with an expense for hauling, brought the cost to 16*l.* 4*s.* 6*d.* Estimating the cubic contents of the silo at 5160 feet, it would appear to hold, at 56 lbs. to the foot, 92 tons, so that the silo costs some 4*s.* per ton, while the cost of cutting, chaffing, and filling upon the basis of the above crop was about the same sum. The silage in this instance was nearly dry, and of an exceedingly bright yellow colour. The sainfoin was somewhat crumbly, as dry clover hay is found in the stack. It was agreeably warm without being actually hot, and the smell was quite equal to that of the best clover hay. There can be no question that silos erected in this manner are exceedingly valuable, inasmuch as they will produce silage quite equal to that made under a more elaborate system,

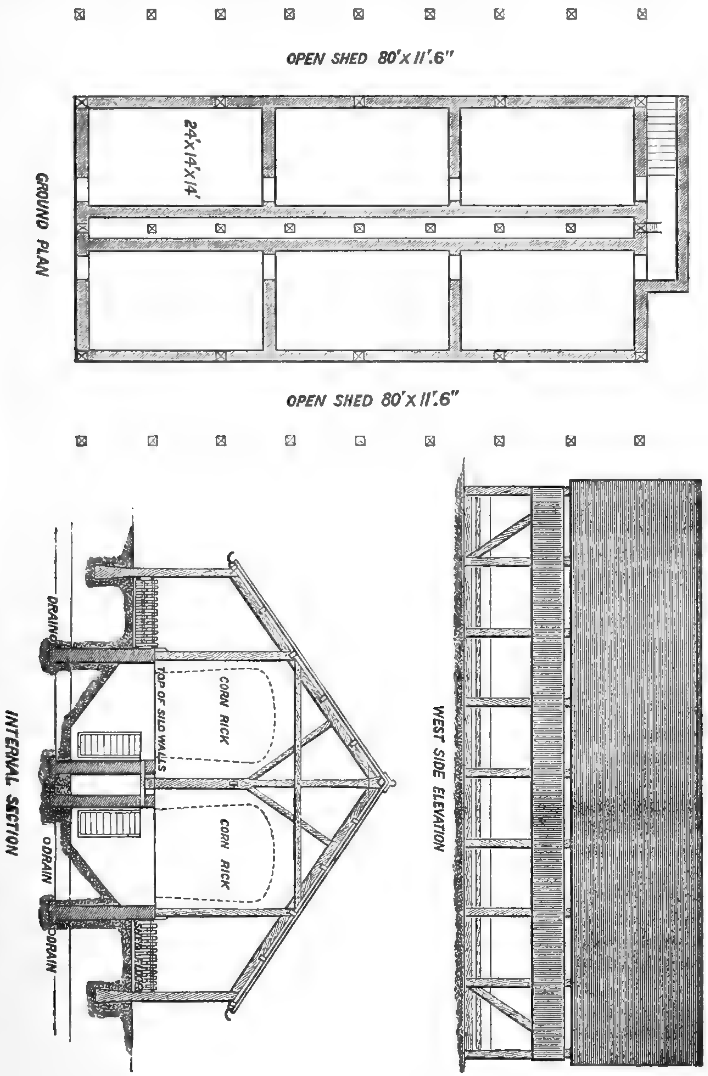
even though rough stones are adopted for the purposes of pressure. If the farmer can afford to overlook the disadvantages which have been pointed out, he can rely upon saving a crop at any season, or producing food for his stock at a much cheaper cost than by the process of haymaking, by simply running a strong wall across the bay of a substantial barn and cementing the interior in a manner similar to that adopted by Mr. Elwes.

Mr. Borer's Silo.—The silo erected by Mr. Borer at Angeston, Dursley, was upon the Blunt system, but it was not an unqualified success. It is an entirely new structure, 11 feet 5 inches in width, 20 feet 9 inches in length, and 12 feet in height inside, 5 feet being below the surface of the ground. The total cost was 35*l.* 8*s.* 9*d.*, including the pressing apparatus, weights, roof, fixing, and excavating 47 cubic yards of earth. Exclusive of the pressing apparatus, the cost of the silo building was 20*l.* The walls are of one-inch red deal, tongued and grooved, and cost, including ledges, tie posts, and fixing, 8*l.* 18*s.* No special floor was prepared, nor were there any drains. The roof is of curved corrugated iron sheets, erected at a cost of 4*l.*, which included bolts and fixing. The wooden building is composed of upright 7-inch boards tied together with horizontal rafters, 2 inches by 4 inches at the bottom, and $2\frac{1}{2}$ inches by $7\frac{2}{3}$ inches from the top, these being bolted together. There is also a post, 4 inches by 4 inches, in the middle of each side, and a tie-beam across the top, to keep the sides from bulging outwards. At one end of the building the top portion of the wooden wall is removable, being screwed to the top rafter. This is for the purpose of assisting in either filling or emptying. The roof, which in shape resembles that of a railway carriage, is put on in sections, as the beams attached to the pressing apparatus cut right through them. When the silo is filled, the silage is covered with boards, 1 inch by 7 inches, but these do not fit quite close. Above these are battens, 7 feet by $2\frac{1}{2}$ feet, placed on edge; while above the battens are the two pressure-beams, which are 12 inches by 4 inches in thickness, and which are laid on edge across the silo, the end projecting through the wood-work or side. Through these ends iron rods are passed, at the top of which is a screw, and at the bottom a stirrup through which the levers pass. These stirrups practically suspend the levers, as when the screws are loosened from the top of the silo, both levers and weights fall; in other words, the weight which gives the pressure bears fully upon the stirrups, and thence upon the pressure-beam above. The levers are about 20 feet in length, and there are two on each side of the silo, both of which have their weights suspended at one end, and not crossing, as shown by the Blunt principle in general. Each lever is formed of two pieces of deal bolted to an iron plate, which is placed between them. They taper to the end, the thickest part being $4\frac{1}{2}$ inches by 6 inches, and the thinnest $4\frac{1}{2}$ inches by $3\frac{1}{2}$ inches. At the top end they are shod with iron, and a hook is provided to which the chain is fixed for the suspension of the weights. At the thick end, near the bottom of the silo, is an iron heel, which is passed through an iron staple fixed in the ground, thus furnishing a suitable fulcrum. As the levers fall by the settling of the silage, a continuous pressure is given; but by screwing down the nuts, at the upper end of the rod, the levers are again raised. It was noticeable that one of the levers in particular was much bent and wrenched out of position by the heavy weight to which it was subjected, its great length clearly contributing to this result. The weights at the end of each lever were three in number, and each 1 cwt. Each hundredweight is estimated to give a pressure of one ton, and as each lever is also assumed to give one ton, the pressure upon the silage was at the rate of 170 lbs. per square foot. It should be mentioned that on the top of the silage was a covering of 3 inches of straw; but this was somewhat affected, together with the silage beneath it, by the ingress of rain through a not very substantial roof. The grass put into the silo was of moderate quality, and uncut. It was

not absolutely good for two feet below the surface, and for three feet from the ends; but when the well-preserved silage was reached, it was found to be of admirable quality, fragrant in smell, and a perfectly sweet taste. A considerable proportion was either spoiled or partially spoiled at the sides, on account of the unequal pressure, the centre of the silo being higher than the sides. In opening, one section of the roof was removed without much difficulty, and then by releasing one lever on each side, four of the covering-boards were taken off, and the silage exposed. The silo is estimated to hold sixty tons. What the exact quantity was it is not possible to say, but the crop of grass was taken from seven and-a-half acres, mown with a machine at a cost of 30*s.* The carting and delivering cost 36*s.*, filling and treading 39*s.*, and weighting 20*s.* Estimating the cubic contents, however, as in previous cases, this silo would hold fifty tons, so that its cost is at the rate of 14*s.* per ton; and as there were probably forty tons of silage, the cost of mowing and making was about 17*s.* an acre, or 3*s.* 1½*d.* a ton.

Mr. Harris's Silo.—The silo of Mr. W. J. Harris, of Halwill Manor, Devon, which was entered for competition (for Mr. Harris has several), was that at Ellacott Farm, Bratton Clovelly. It is a combination building, covered by a span roof 60 feet by 80 feet by 25 feet high. There are six receptacles, or silos, excavated in the earth, each being 24 feet by 14 feet, by 14 feet deep. These silos, three on either side, are divided by a broad central wall 6 feet in width, and by party walls at equal distances, which are 18 inches thick, so that the actual silo space is two lengths of 24 feet by 14 feet, or, in all, 4704 cubic feet, equivalent in Mr. Harris's opinion to holding 600 tons of silage. The whole of the silos can be reached from either end. At one end two apartments are entered through doors on each side of the central wall from the bottom of a short flight of steps; whereas at the other end, where the ground is lower, the silos are entered from two doors placed in a similar position, and against which the waggons can be backed. Other doorways are made in the two pairs of partition walls, so that there is regular communication from one end to the other. One end of the building is enclosed by means of corrugated iron, and the other with wood. The outer walls of the silo are carried to a height of some 3 feet, so that they can be filled thus far above the ground. When filled and covered with earth or boards, they practically make the floor of a covered stack-yard, and this is one of the principal features in Mr. Harris's plan, the extensive covered space enabling him to erect six hay or corn ricks on the top of the silos, equal in size to the capacity of this portion of the building. Indeed, more than this, for the entire length of the central wall, 6 feet by 80 feet, can be utilised for this purpose. There is, however, another most important feature, for it will be seen that, although the width of the silos with the central and outer walls is only 37 feet, the roof is 60 feet. As a matter of fact, this covers an extensive gangway on each side 11½ feet in width. Both gangways are enclosed at the ends by gates, and at the sides by five rows of strained wire fixed to the upright posts which support the roof. The sides, too, are partially enclosed on the weather side by galvanised corrugated iron, a depth of 5 feet of which descends from beneath the eaves. There is ample room in these gangways for a number of waggon-loads of corn to stand, and for either a herd of cattle or a flock of sheep on either side, all of which can be fed with extreme facility from the silos. The earth removed in making the silos was 1068 cubic yards, at a cost of 50*l.* The walls, 18 inches thick, are built of stone raised on the estate, and finished at the top with 2 feet of brickwork. Their cost was 150*l.* The walls, too, are cemented at a cost of 60*l.* with Portland cement mixed with two parts of sharp sand, the corners being slightly rounded. The floors are of cement laid upon a bed of broken stones 4 inches in thickness, their cost being 20*l.* The mortar used in the whole of the work was made

Figs. 10–12.—*Plan, Section, and Elevation of Mr. Harris's Silo.*



from stone-lime mixed with sharp river-sand. Drains are provided beneath the structure for the purpose of carrying away possible pressure from spring water. The material used in the construction of the roof is red deal and 22-gauge corrugated iron of the best quality. Its cost, including the covering of the side, was 170*l.* The total cost of the silo was 542*l.*, the remaining items being made up by charges for oak posts, drains, galvanised wire and shooting gates, and sundry boarding. The compartments at the north end of the silo, which is reached by the steps referred to, are 3½ feet below the passage at the bottom of the flight, and in all cases the doors or openings into each compartment reach almost to the top of the silos. At the time of our visit five of the silos were filled, four of these having stacks built above them, and one was a silage stack, which is alluded to in the Report of the stack competition.

The first silo opened for our inspection may be termed No. 1. In this were 39 cart-loads of clover and rye-grass, averaging 1900 lbs. each, 39 loads of trifolium, which averaged over 15 tons to the acre, and, at the top, 18 loads of grass. In all cases the silage was unchaffed. The clover was rather light green in colour, and had an alcoholic smell; but the trifolium and grass, which were slightly darker in colour, especially the latter, appeared to be much more acid. The depth of the silage in this compartment was 10 feet. It was cut right across the face, and was extremely even in appearance as regards each layer, the average weight being about 50 lbs. to the cubic foot. Mr. Harris had adopted the plan, which was precautionary, of ensiling the trifolium and the clover in alternate layers. The whole was exceedingly well preserved, the sweet vernal, foxtail, timothy, and the fescue grasses being all preserved as perfectly as possible, and indeed the trifolium and rye-grass were equally so. A layer of about 4 inches in thickness was spoiled at the top, and a triangular piece, similar to that found in almost every silo, was also spoiled at the sides of the top, but upon the floor and at the sides for at least 9 feet upwards the silage was quite perfect.

The quantity of silage in the second silo opened was 11 feet in depth, and consisted of 81 loads of grass at the bottom, which was commenced to be put into the silo on July 16th, 6 loads of vetches and 20 loads of oats at the top, in alternate layers, which were finished on the 10th of August. The oats were carried wet, but had the flavour of tamarinds, both to the smell and taste. The grass, which was a very heavy crop, was of poor quality, and contained a quantity of plantain, which Mr. Harris pointed out was well preserved, although when made into hay it is generally wasted by drying and breaking up into a powder. The silage in this compartment was quite good to the top, if we except about 3 inches on the surface, and a small proportion at the corners and top sides. The grass reached to 6 feet 6 inches in height, and the oats and vetches were 4 feet, the remaining portion of the space being occupied by rushes and rubbish with which the silage was covered in place of boards. For weighting, Mr. Harris used concrete blocks 1 foot square, and weighing 130 lbs. They are made of stone and cement, and a handle for lifting is let in at the top. He also showed us, although these were not in use, some terra-cotta 28 lb. weights, costing 45*s.* a ton, indentations for the fingers being provided at each end. They are 12 in. by 6 in. by 7 in. thick in size, and are made at the Marland Clay Works, North Devon. A quantity of the silage was, at our request, taken to the sheep in the fields, and to the Devon cattle in the stalls, and although it was of the coarsest quality, it was greedily eaten for the first time, no hesitation being exhibited by any of the animals. In answer to a question respecting the convenience of moving the concrete blocks, which are generally stacked on the central 6 feet wall, Mr. Harris said that about forty loads will fill each silo the first time, the operation occupying from two to three days, Mr. Harris preferring

not to do it all in one day. The blocks are then laid round the sides, and the grass is forced down about 4 feet. They are subsequently lifted to the wall again, and the silo filled to about 1 foot above the top. The blocks are then put on a second time, when a pressure of 130 lbs. to the square foot is given around the sides only, the centre subsiding almost as much as the sides, although entirely without direct pressure. At the second filling a couple of waggon-loads of rushes are spread over the surface, the weights are put in their places, principally round the sides, and the thing is finished. Pulleys have been used for removing the blocks, these being attached to the cross-beams above each silo; but it is found that removing by hand is quite as expeditious. After each second filling, the silo is allowed to remain for a week or ten days, while others are being filled. At the end of this time it has sunk at least 4 to 5 feet. The rushes and weights are then removed, and about forty more loads of green fodder added, when the entire work is finished by covering as before, with the addition of a waggon-load of fresh rushes, on the top of which stones and gravel are placed. Where corn-stacks have been built upon the silos, faggots have been used as a division between the two, but Mr. Harris believes this precaution quite unnecessary, and will not adopt it in future. In feeding, Mr. Harris finds that it is necessary to give cattle dry food at the beginning of winter before giving silage, as, if the latter is given first, the dry food is apt to be neglected, and he does not believe that they do so well on silage alone as upon a mixture. Exception, however, may be made with regard to yearlings, which thrive quite well upon the silage and the grass they get while at liberty. Mr. Harris prefers the sweeter kind of silage, and although in the first instance the taste of his milk was affected, this has entirely gone. Oat silage is never found to give any taste whatever. It will be noticed by those who have studied silos for some time that the Ellacott silo somewhat resembles that of the Vicomte de Chezelles in Normandy, which has been frequently described, and which was visited by a number of English agriculturists at the beginning of the silo movement. Mr. Harris has, however, improved upon this, and declares that he formulated his own plan from studying that of the French nobleman above mentioned. He says that it will pay him splendidly, and his idea is to charge 30*l.* in his balance-sheet for capital invested, 15*l.* of which will be for silo rent, and 15*l.* for the rent of the covered yard, which is large enough not only to cover the hay or corn upon a good-sized farm, but almost the whole of the stock and implements possessed by the majority of farmers at the present time. It may be added that the span roof is supported by posts cut from oak grown on the estate. There are nine on each side of the gangway supporting the eaves, nine in the centre of the 6-feet way supporting the ridge, and five on each side of the silo walls. The work was done by Mr. M. White, of Halwill, who has exhibited considerable ingenuity in the construction of the roof. It may be noted, also, that in addition to the advantages referred to above, there is great facility for filling, as the waggons can be drawn up by the side of each silo, if necessary, to the extent of half-a-dozen at a time. The silos can be emptied from the top in every case, and from the bottom at both ends, and directly into a cart at the south end. The weights can be moved from one silo to the other with great rapidity, there being an objection to the stacking of corn upon silage, which might be wanted before the corn was threshed. Mr. Harris explained that he principally grows oats, and threshes these before he requires to use his silage. He also uses his hay at the same time as the silage, so that he can always have silage uncovered to a greater extent than that required for a month's consumption. He calculates that he effects a saving of nearly 20*l.* per annum by no longer requiring to thatch his corn and hay-stacks. The side sheds or gangways are, moreover, necessary for the shelter of the sheep in very rough weather, and for the protection of a steam-engine

and threshing-machine, which would otherwise have had to be provided with a new building.

Mr. Hellier's Silo.—The silo erected by Mr. W. G. Hellier, of Wick St. Lawrence, near Weston-super-mare, Somerset, deserves special mention, inasmuch as it is the only absolutely wooden erection entirely built above ground which we saw during our inspection. It is 24 feet long by 12 feet wide and 10 feet high, and is built of deal, the posts being let into the ground 2½ feet deep. Each hole is 18 inches square, and filled up with a concrete made of gravel, brown lime, coal-ash, and sand. The foundation trench was also dug 18 inches deep by 18 inches wide; and this, too, was filled with the concrete. Three quarter-inch deals were nailed on each side of the 7-inch by 3-inch uprights, and the space between was entirely filled up by sand. There were no drains, and no especially prepared floor. The wood used in the erection, together with the sand, cost 18*l.* 17*s.*, and the roof, which is a portable one, and made of quartering, covered with two-ply Willesden paper, 3*l.* 17*s.* The total expense of the silo, including 5000 bricks, at 45*s.* a thousand delivered, and used for weighting, was 34*l.* 15*s.* It was built by Mr. Hellier himself, assisted by one man. There is a door at one end of the silo, which is double, the space between being filled with sand, and, when the outer door is removed, the space between is cleared before the inner door can be opened. The silo is filled at the top through a door or opening 7 feet above the ground. The structure is a tolerably strong one, and especially well put together for an amateur, although the quantity of sand used, 20 tons, caused the sides to bulge to a small extent. The grass, preserved unchaffed, was 45 loads, and was mown with a machine; it was carted at a cost of 22*s.* 6*d.*, the filling costing 15*s.* Upon opening the silo, the depth of silage was found to be 6 feet, scarcely reaching to the top of the door, one layer was of clover and the rest grass. It was slightly spoiled at the sides, and, on cutting out, the usual triangular section was found at the top. The weighting was obtained by means of bricks, five high, equal to 140 lbs. to the square foot, standing upon boards ¾ inch by 7 inches. The silage was exceedingly good, excepting the portions mentioned above, and a thin crust at the top. Mr. Hellier's system is satisfactory, and must be of especial value to a dairy-farmer like himself, paying in rent, rates, and tithes, 3*l.* 12*s.* an acre, when he is unable to sell a single ton of his produce, although he has only 5 acres of arable out of 150 acres upon his farm. This gentleman and his family before him have lived upon the same farm for 260 years. He has hitherto fed his herd upon hay, and in consequence of the price of dairy produce he has been a considerable loser. He is of opinion, and we think he is right, that silage will, to some extent, ameliorate this unfortunate state of affairs.

Mr. Tanner's Silo.—The silo entered by Mr. Tanner, of Clapton Court, Crewkerne, is built under the roof of a covered yard, and is 18 feet 2 inches by 18 feet 4 inches by 16 feet deep, 8 feet being below the surface of the ground. It is divided across the centre by a wall, and forms one-fourth of the covered yard, which is 40 feet square. There are two openings, or doorways, for emptying, one on each side; before filling commences, these are blocked up with sliding-boards, 9 feet by 1½ feet, placed crossways in a groove, and corked with tow and red lead. The walls, erected for the purpose of the silo, are 9 inches thick, and are of brickwork, but the original walls of the covered yard are of stone, lined with brick. *All* are faced inside with a mixture of sand and cement. The floor is of concrete, covered with a layer of sand and cement. There are no drains. The roof, which is covered with Bridgewater tiles, was built over the entire yard some ten years ago. The system of pressure adopted is that made by Reynolds, the cost being 16*l.* Excavating cost 50*s.*; builder's work, 53*l.*; bricks, 14*l.*; sand and carting, 10*l.*—total, 93*l.*,

or, estimating the silo to hold 105 to 110 tons, considerably less than 1*l.* a ton. The crop preserved was grass cut from fifteen acres which would have made two tons of hay per acre. It was got dry, although a little rain fell, and was not chaffed. When the filling was completed, a layer of nettles and other green rubbish was spread over the top; and the covering-boards, 12 feet by 2 feet, which did not fit close, were put on crossways. Over these, lengthways, the pressure-beams were fixed. These ran the whole length of the silo, and were composed of two pieces of timber, each 3 inches by 11 inches, fixed together by two smaller pieces of wood between them. At each end of the beams are the cog-wheels over which the chains pass. These chains, two to each beam, pass from the bottom up the walls of the silo over the wheels, which rest in iron chairs, to the centre of the beams, where they are screwed together, and the pressure exerted. When necessary, the beams are hoisted above the silo by means of pulleys attached to the roof. The filling of the silos extended over a fortnight, Mr. Fry's system having been adopted. The temperature varied considerably. On the 30th of June, soon after filling, it was 135 degrees, and on the 6th of July 135, but it had risen to 170 before the pressure was at work. This was the maximum temperature, but at the time of opening, in our presence, it was only 100 degrees. The silage near the door, when opened, was found to be very black, and resembled heated hay in its perfume. The top layer, however, was light in colour, and its smell very unlike ordinary silage, although by no means disagreeable. A hole was cut from the top of the silo, the quantity spoiled being rather considerable at the sides, where pressure did not seem to be exerted; indeed, in many cases it was apparent that the centre would have practically taken care of itself, if the sides had been properly pressed. At Clapton, however, the pressure was principally across the right and left centre, but deficient at both sides and ends, the beams not being able to adapt themselves to the inequalities of the surface.

Lord Wolverton's Silos.—Two silos were entered by Lord Wolverton, one known as the Church Hill, and the other as the Hill Barn. The former is an entirely new structure, 62 feet long by 12 feet wide, and 18 feet high. It is an excavation on the side of a hill, the eaves of the roof being slightly above the level of the ground upon the one side. There are three compartments made by two partition walls, each of the former being 20 feet long. Openings are provided in the roof of each compartment to facilitate the operation of filling, whereas emptying is conducted by a door in the south end and an opening in each partition wall. The total expense was 280*l.* 8*s.* 3*d.* Excavating 540 yards cost 18*l.* 4*s.* 6*d.* Three walls are of cement-concrete 12 inches thick; the south wall is of brick 9 inches thick; and the partition walls, which are also concrete, are 12 inches thick. The cost of these walls was 147*l.* 1*s.* 8*d.* The cement and sand used for facing the interior cost 31*l.* 14*s.* 11*d.* The floor, which is of 6-inch cement-concrete covered with 1-inch cement, cost 19*l.* 4*s.* 3*d.* Drain-pipes are laid round the outer walls, at a cost of 3*l.* 9*s.* The roof is of a light frame-work of deal, covered with galvanised corrugated iron. This item cost 42*l.* 7*s.* 1*d.* The doors in the roof are provided with hinges and padlocks, and open next to the road, so that the carts can come up close for filling. In No. 1 division the silage consisted of maize and the skimmings of a water meadow, the maize being chaffed. Mowing the crop cost 1*l.* 10*s.*, carting, 4*l.* 3*s.* 6*d.*, and filling, 17*s.* This silo was covered with Stock's screw press, costing 18*l.* The covering-planks used were 8 inches by 1½ inches, these being placed crossways. Over them were four beams, 3 inches by 7 inches, laid the reverse way; and again on the top of the beams were two pressure-beams, 7 by 5½, laid crossways, at about the right and left centre of the silo. It is through the centre of each of these two beams that the screw passes. Upon opening, it was found that the pressure had not been

equally distributed at the sides, but the corners in particular were a distinct failure. The maize was cut from 16 acres of land, upon some portions of which it failed; whereas upon other portions it averaged thirty tons to the acre. It was drilled during the last week in May, but the seed appears to have been the round instead of the flat hardy variety. The centre silo, No. 2, was filled with water-meadow grass and maize chaffed—thirty loads of the former, averaging 35 cwt. per load, and twelve loads of the latter, averaging 30 cwt. In this case the silage had sunk 7 feet below the eaves. Except at the corners and the sides at the top, the mass was good close up to the wall, although, as usual, it smelt very strong. The grass silage was pale in colour, and practically sweet. In each silo the corners were square, and a considerable proportion of the top layer was spoiled. The Reynolds pressure system in this compartment cost 12*l.* No. 3 silo was weighted with bricks at the rate of 84 to the square foot, nine tons having been used at a cost of 28*s.* per ton. In this instance cutting, delivery, and filling cost 11*l.* 15*s.* 8*d.*, but the result was not satisfactory, a rather large proportion being spoiled at the top and corners. The cost of fitting and fixing the pressing appliances in No. 1 and No. 2 was 11*l.* 10*s.* 6*d.*

Hill Barn Silo was in every sense more satisfactory, being a sensible adaptation of one end of a barn. Its length was 37 feet 6 inches, width, 17 feet 1 inch, and height, 9 feet 10 inches, with a supersilo of 2 feet 9 inches high. This silo is divided in the centre by a wall, making two apartments, each 8 feet 2 inches wide. It is filled from the floor of the barn, and emptied by a door in the end of each compartment, both of which open into the barn. The excavation for floor and foundation cost 28*s.* The old chalk walls of the barn were lined with 4½-inch brickwork, and the end wall with 14-inch brickwork, whereas the partition wall was of 9-inch brickwork. The work cost 42*l.* 12*s.*: cementing the interior cost 28*l.* 7*s.*—an item which was somewhat extravagant; while the concrete floor, also an expensive work, cost 14*l.* 5*s.* Upon our visit the right-hand silo was empty, but the left-hand one was filled with the first cut of a second year's clover. When cut into, the silage was distinctly alcoholic in smell, and was very perfectly preserved right up to the wall. A small quantity was spoiled at the top and in the corner examined, but the experiment was quite a success, in contradistinction to that at the other silo. The weighting, at the rate of 70 lbs. per square foot, was provided by means of flints packed in gaseline-boxes, 15 inches by 20 inches. At each end of the boxes were hoop-iron eyes for hauling up with a pulley. The covering-boards were 2½ feet wide, and the exact length of the silo. The clover-crop preserved consisted of 16 loads of 35 cwt. each, and cost for mowing, 2*l.*; for carting, 5*l.* 6*s.* 8*d.*; and for filling, 2*l.* 4*s.* 8*d.*

Messrs. Ward and Lawry's Silo.—This silo was inspected at the farm of Mr. Lawry at St. Dominick, Cornwall, and is especially worthy of mention on account of the system—the first of the kind seen during the inspection,—of lifting the weighting material. The silo is attached to the stone wall of a cowshed, and divided into two equal compartments, each measuring 10 feet by 15 feet by 11 feet high. The floor of the silo, which is concreted, is level with that of the cowshed, into which it opens, and the top of the silo is slightly above the level of a rising field at the back, a quantity of earth having been excavated. There is a supersilo or shed-room above the walls, with a cubic space of 3000 feet, the silos having 3300 feet, and being estimated to hold 56 tons. The material used for ensiling was trifolium, 1½ acres, and seeds from 5 acres. When filled, the silage is covered with boards nailed together, to 3 feet wide and 10 feet long, the weighting being managed by the use of granite blocks, each weighing from 4 cwt. to 6 cwt. A hole is made at the top side of each block, into which a lifting-bolt and ring are inserted at

the time of moving. This contrivance is similar to that used in granite quarries, and can be fixed and removed in a moment, a single tap releasing it. Over the top of the silo two rails are fixed, these running upon a pair of wheels at each end, a stage being erected at the outside for the purpose. On these rails an ingenious trolley-pulley runs, and this, being placed with ease over any portion of the silo, lifts the huge blocks, and drops them either in the adjoining silo or outside with the greatest facility. The rails are upon two plain oaken beams, 11 inches by 4 inches by 38 feet long. One end rests upon a rail attached to the wall of the silo, and the other on a similar rail upon the stage referred to. The man employed in hauling, with this appliance can lift half a ton, and there is no possible danger from the stone falling or slipping, as a ratchet is provided at one end, and a brake at the other. The granite used cost 1*s.* 6*d.* per ton at the quarry. The total cost of the silo and weighting apparatus was 87*l.*, the proportion paid for the tram-rollers, pulley-trolley, and weights, being 27*l.* 2*s.* 5*d.*; and for the roof, which is of oak, at 1*s.* per cube, covered with galvanised iron, and provided with a lead-gutter, 14*l.* 17*s.* 7*d.* The maker of the trolley is Mr. Isaac Rosekilly, of Gunnis Lake. The silage made from unchaffed seeds of the first year included clover, rye-grass, cocksfoot, and timothy, which would have made 35 cwt. of hay per acre, whereas the trifolium and Italian rye-grass were estimated at from 19 to 20 tons per acre. They were put in during fine weather, filled at three separate periods, and came out tolerably dry, fairly sweet, and good; except that the silage failed in the corners and near the walls, as in other instances. Where stone, or any weighting material difficult to move, can be obtained at a low price, the apparatus referred to above should claim close attention, inasmuch as it is extremely simple, and as effective as it is possible for a lifting apparatus to be.

Mr. Martin's Silo.—The silo entered for competition by Mr. Thomas Martin, of Rope Walk Farm, St. Agnes, Cornwall, was one of the best in the western district, and is very distinctly superior to some of those which were left for a second inspection. There are two features which merit special consideration, inasmuch as they are so practical and economical as to deserve imitation by farmers desiring to make silage with as little trouble and expense as possible. The silo is a building erect d from stone raised upon the farm, and leaning against a granary and cattle-shed. It is 30 feet long by 12 feet wide, and 10 feet 6 inches deep, being sunk 3 feet into the ground. In one corner at the top is an entrance from the granary, and in the yard outside is a door in the end, which is blocked up with wood and a large sheet of galvanised iron. The floor is of concrete, and the 18-inch walls are well cemented. Thus it is a perfectly plain, well-built apartment. The lean-to roof, however, is made to lift up. It is of galvanised iron, and divided into two portions. The top back portion, 4 feet in depth, is fixed, but the front portion is hinged to cross-pieces bolted to the rafters. The rafters, which are 5 feet apart, are 7 by 2½, and let into the wall of the old building, and lay upon a wooden plate on the front wall of the silo. When in process of filling, the roof is lifted up and kept in position by props resting on the wall, which are fixed, and prevented from slipping by a bolt and button. The silo is then filled by waggons drawn up by its side. When closed, it is firmly fastened down by chains affixed to eyes within. The roof, when propped up, is 5 feet above the wall, thus giving ample space, and it was 7 feet above the silage when inspected. The only feature which might be improved is with regard to the difficulty in treading close to the outside wall, as, although the roof is lifted, the rafters remain fixed, and thus prevent the treading being so perfect as could be wished. Mr. Martin, however, considers that in practice this is not so great a difficulty where earth is used. The silage is covered with 2-inch planks, cut in 6-feet lengths, and laid crossways; but near the door, where the

first cut took place for inspection, they were in 4-feet lengths. Above this, it is covered with 18 inches of earth, the only weighting material used, this averaging 120 lbs. to the square foot. In cutting out, the earth is thrown back until one cut across has been made. It is subsequently thrown to the bottom of the silo as removed, evenly spread, and covered with the boards taken from the top, so that the silage is kept clean. When, therefore, the silo is emptied, the whole of the dry earth is upon the floor and ready for use the next season. In order to get it to the top again, Mr. Martin has devised a simple and ingenious plan by which he hauls it into his large granary above, and this feature is worth noticing. Barrows are filled one by one, and hauled up by a wheel and pulley with a power of eight to one, ordinary cart-ropes being used. This pulley is also adapted to lifting the silage to the granary for chaffing, and can be removed for use upon any other part of the farm. The cost of fixing and making Mr. Martin estimates at 20*s.* The earth for weighting consisted of 20 tons, which was carted and spread by four men with two horses in a day, at a cost of 16*s.* Being hauled into the granary, it simply remains to be wheeled on to the top of the silage when the silo is filled. On the top of the earth, after filling, there is ample room for the storage of straw, hay, roots, and, in fact, almost anything requiring space in the farm-buildings. The efficacy of the earth-system was shown by the perfection of the top layer of silage, none of which was spoiled, although, for some inches below, mould was found. In colour it was a yellowish-brown, the grasses and clovers being perfectly preserved. The smell was strongly alcoholic, but a sample which had been taken from the silo three weeks before, though very perfect in other respects, had a pungent acetic smell. In using it for feeding purposes it is all chaffed with straw for the stock. The cost of the whole was 37*l.* 15*s.* 10*d.*, the proportion for the roof being 11*l.* 16*s.*

Mr. Cornish's Silo.—In this instance three systems of weighting or pressure were adopted, Mr. Cornish evidently being under the impression that he could not have too much, and preferring to err on the side of excessive than of little weight. The silo is 40 feet by 10 feet by 20 feet deep, and is principally excavated, although on the side next the road at the eaves it is only 18 inches high. The form is a lean-to, and it is intended to erect another silo of a similar shape at the back. The walls are of native stone, and vary from 20 inches to 4½ feet in thickness. Over 9000 cubic feet of earth were removed at a cost of 19*l.* 6*s.* 8*d.*, the total cost being 82*l.* 10*s.*, and that of the apparatus used in weighting 25*l.* 18*s.* 7*d.* The roof is of galvanised iron, costing 11*l.*, and is formed of 2½-feet sheets next the ridge of the eaves, and 9 feet in the centre, in which an opening is made for entrance to the silo. The weighting is arranged in three ways. First, there are iron ship-tanks of water, which are filled with great ease from a pond upon higher ground, and as easily emptied with rubber tubing and a siphon, on to the lower ground behind. Next, there are frames 10½ feet by 3 feet, made of 2-inch by 7-inch battens with galvanised-iron sheets screwed on the bottom, and costing 11*l.* 5*s.* per ton. Each frame is divided into three compartments, each compartment holding 5 cwt. of washed gravel, costing nothing but the drawing. Lastly, there are levers which are somewhat ingenious, and which operate similarly to those used in other silos, although differently made. Two pressure-beams run the whole length of the silo. Each beam is composed of two pieces of timber, 2 inches by 7 inches laid on edge, lined with fender iron, and united by pieces of 6½-inch timber placed every 3 feet. Upon each of these pressure-beams is a chair in which the levers are bolted. The latter are 21 feet long by 3 inches wide, and vary from 11 inches in thickness at the butt to 4 inches at the end. They are covered on the top and sides with sheet iron. For obtaining purchase, bars of iron 2½ inches by ⅜ inches are fixed into the bottom of the silo and run up the walls. These are pierced with holes, through either of which

a bolt is passed, the ends of the bolt passing through the rings at each side of an eye attached to a hook at the bottom of a large screw, upon which a cross-bar is worked followed by a nut. The heel of the lever is passed under this cross-bar, and purchase is immediately obtained. The nut can also be screwed with a spanner, pressing the bar still further down, and the lever can be weighted with any suitable material, so that the necessary pressure is secured. The silo is filled through the roof and emptied from the doors near the cattle sheds at the bottom. This is blocked up by two layers of wood with tarred calico between. The doors are also tarred. The silage was a first cut from 12 acres of clover and rye-grass, estimated at 70 tons, being 8½ feet in depth. It was perfectly good to the walls, failing only at the corners and slightly at the surface. (See Table, p. 306.)

There is one feature in connection with silage as a food for dairy cows which is of such importance that it is necessary to refer to it in a report of this somewhat comprehensive nature. Sour silage, like pitted grains, conveys to milk a quality which appears to disqualify it for conversion into refined cheeses, such as Brie, Camembert, and Coulommiers, which, in their process of ripening, develop a ferment. This fact I have found generally understood by French cheese-makers in the Brie district, and it is my own experience when feeding on silage.

In concluding this portion of the Report, my colleague and myself are of opinion that the system and appliances adopted by Messrs. Ward and Lawry and Mr. Martin, in their Cornish silos, are deserving of very high praise, and that the silos of Lord Wolverton (Hill Barn), Messrs. Tanner, Elwes, and Hellier, were successful in practice, and in many respects economical.

Silage Stacks.

The first stack inspected was that of Mr. Mark Amos, at Westbury-on-Trym. The material used was sewage grass, and the size of the stack as described on the entry form was 10 feet cube, but at the time of our visit it was 10 feet by 9½ feet by 6 feet high. The top was semicircular and covered with sheets of corrugated galvanised iron. The sides had been cut down and dressed with a composition of salt, sugar, and fenugreek. The stack, which was pressed by Amos's Patent Lever and Gear, at a cost of 7*l.* 5*s.*, was built upon three wooden beams, each of which passed through an iron eye fixed to chains, to which 2½-inch iron bands were attached, these passing over the stack for the purposes of compression. It should be mentioned that, besides the galvanised iron, seven planks 2 inches by 7 inches were laid crossways over it to enable the compression to be more evenly distributed. When fixed, the bands referred to are tightened by Amos's lever, a simple apparatus, which is applied to the chains at the side. The crop, estimated at 13 tons, cut in the rain, made silage which was exceedingly heavy. The outsides, however, were black and spoiled for a considerable distance in the stack, the smell being most disagreeable, although it improved as the interior was reached. A sample subsequently sent us from the centre of the stack was much better. The temperature was raised to 112 degrees for a few days only.

The second stack visited was that of Mr. Harris, at Ellacott Farm, Devonshire. This consisted of 25 loads of second-crop clover, 5 loads of meadow-

grass, and 31 loads of green oats—in all about 50 tons. It measured 23 feet by 13 feet by 5 feet high, increasing to 7 feet in the centre, being built upon silage under a covered roof. The oats were cut dry, but the clover was cut in the rain. Pressure was obtained by Reynolds's system, which has been previously described; but upon cutting the outside of the stack the quality at the sides and for some distance in the interior was not found to be all that could be desired.

The last stack in the western district was that of Mr. J. J. Carpenter, of Bannadon, near Bratton, Clovelly, Devon. It was 15 feet by 12 feet by 5 feet high, and consisted of a second cutting of clover and seeds, the produce of seven acres. The stack was built upon fir poles laid across three sleepers. On the top of the grass, when the stack is built, a number of planks are laid, and across these three beams, through which two chains attached to the beams on the ground are passed. These chains are also passed through other beams which are movable. Beneath the latter, and standing on the beams at the top of the rick, a screw-jack is placed, pressure being obtained when the jack is worked, inasmuch as when the movable beam providing the resisting power is lifted as high as it can go, the actual pressure-beam is forced down. When the jack has done its work, a bolt is passed through one of the links in the chain to prevent the pressure-beam from rising, and the jack is removed to the other end. The plan appears to be a feasible one, but the stack was certainly not a success, as all the beams got out of position, and were lying on their angles. The top of the stack was covered with rushes and thatched in the ordinary way. The silage was nearly black, but it was sweet. A considerable quantity, too, was spoiled and mouldy at the sides and corners The beam used above the jack is provided with four legs to keep it in position. A silage stack would undoubtedly be of great service upon this gentleman's farm, which is in a very wild district upon Dartmoor.

IV.—The North of England. By J. K. Fowler, of Great Missenden.

Silos.

Mr. Trepplin's Silos.—Mr. Baker and I arrived at Kenilworth on November 12th, to inspect the silos of Mr. C. F. Trepplin, who farms 3000 acres of land, principally as a tenant under the Earl of Clarendon, and partly as an owner. He is a great believer in silage, having this year cured the produce of 900 acres under a variety of systems. In passing, we inspected silage made in an old clay-pit, by simply bricking around the sides and at the bottom, filling it with grass, as cut, without much consideration as to whether it was wet or dry when carted; and when filled, the silage was merely covered over with earth to the depth of about 6 inches, and left open, that the cattle even walked over the top of it, from the adjoining field. Mr. Trepplin sent two entries. No. 1 was for a silo in a pre-existing barn, 42 feet long by 17 feet wide and 17 feet deep, filled and emptied from the floor and sides; it is lined with battens and boards, adjoining the bay of the barn, which cost 17*s*. The floor, which was a sandy loam, had been excavated about 2 feet 6 inches, at a cost of 2*l*.; there was no drain; the mowing of the grass cost from 9*d*. to 1*s*. per acre; the silage was covered in with sand, which had to be removed from near the barn, and which is spread on the meadows when the silo is emptied in the winter, and the sand of no further use for the season. Entry No. 2 was for a silo, new on three sides, and on the fourth side a wall was raised 7 feet; the size was 44 feet by 34 feet and 18½ feet deep, with part of an old barn 15 feet by 15 feet adjoining; it can be emptied from above, or

from a doorway below. About 250 yards of soil were excavated, which raised the ground outside from 2 to 5 feet. Total cost—

	£	s.	d.
30,000 bricks made at home by his own men	30	0	0
Bricklayers and labourers	24	10	0
Lime, 1*l.* 12*s.*; cement, 1*l.* 11*s.* 6*d.*	3	3	6
Excavating, 6*l.* 15*s.*; timber, 4*l.* 1*s.* 9*d.*	10	16	9
Carpenters, 2*l.* 19*s.*; ditto, 2*l.* 5*s.*	5	4	0
Slates for roof, 10*l.* 8*s.*; covering with earth, 17*s.* 6*d.* ..	11	5	6
	£84	19	9

Floor partly sand and partly clay. The roof was of timber and corrugated iron, costing about 12*l.* 13*s.* Chaffing is not practised, and the cost, inclusive of cutting and of putting into the silo, was about 7*s.* 8*d.* per acre. We first inspected No. 1 silo, which contained the produce of 50 acres of meadow-grass, and is computed to contain 200 tons. The height of the silage when we measured it was 12 feet 4 inches, it having subsided about 4 feet 8 inches; it was covered with earth about 6 inches in depth. When being filled, a horse with a boy riding him was employed as well as the men in treading and pressing it down. When we cut into the silage from the top to the bottom we found about six different varieties, which probably arose from the state of the atmosphere when the silo was being filled. Some was exceedingly sweet, and some rather sour; the latter we were told had been carted during heavy rain, the water running out at the bottom of the carts, and the men being completely wet through. The lowest stratum was carted when the weather was fine, and to our thinking was the best. The walls of this silo were built of rough stone, and not cemented, which caused air to be admitted, and thus produced a certain amount of mould. The contents were fairly good. We then inspected No. 2, which, it will be seen, was a very large silo, part of a large barn, with corrugated iron roof, and weighted and covered with earth like the former. The earth was drawn up in baskets with a pulley by a horse, and evenly spread on the silage; no planks were used, and the subsidence after filling was not more than 3 feet. The quality of the silage was more uniform, with no mould at the sides, and very little damage on the top. This was a most useful specimen of good fodder, and a valuable illustration of the possibility of carrying out the system on a large scale at little cost. The cause of the great success of this very large silo evidently was that great care was taken in pressing and treading it effectually at the proper time. Mr. Trepplin considers there are from 500 to 600 tons in this silo. The upper space under the roof is used as a receptacle for straw; were it not for that and for other dry storage, he says that he would not go to the expense of roofing. The silo was commenced filling on July 14th, and finished on August 20th. We think it would be interesting to state some facts communicated to us by Mr. Trepplin. He says he has gone into the practice of ensiling, as he wants an immense amount of food for winter use for his stock, especially milking-cows, to which he gives no other fodder, and he feels sure they give more and richer milk, and keep in better condition with silage than hay. Each cow has, in addition to the silage, 3 lbs. of meal per day; the silage is chaffed with a little oat-straw, the meal is composed of maize, wheat, and barley. In the larger cowshed the cows are tied in rows, with a passage between them about 12 feet wide made of old railway sleepers, along which an iron tramway is laid for the waggons of food to pass along; a trough for water and for mixing the food runs in front of each row. The cows have cabbages from October as long as it will last, and then silage. The cattle seem to be healthy, but not in high condition. About 700 head of cow stock is kept, and 300

are milked daily; the average amount of milk per cow throughout the year is about 6 quarts daily. The milk is sold wholesale in Warwick and Leamington, and some also goes to London, the average price throughout the year being 11*d*. per gallon of 4 quarts. Mr. Trepplin delivers it. No complaint has been made that the milk or butter tastes of silage, nor should it ever do so if proper care is taken that the men wash their hands after handling it; and in all cases the milk, after being drawn from the cow, should not be allowed to stand in the shed. The produce of the cows at the high price realised seems excessive, but the contiguity of the premises to the towns of Leamington and Warwick is a reason why it is so high. Mr. Trepplin is a very energetic and persevering man; and Lord Clarendon, his landlord, may well be proud of such a tenant. We think these silos are worthy of special notice.

Mr. Darbishire's Silo, Pen-y-groes, near Carnarvon.—This competitor describes his entry as a new building divided into two silos, of 12 feet by 14 feet, 12 feet deep, and 11 feet to the eaves. It is above ground, and is built of stone and roofed with slate, having a travelling-crane to lift 6 cwt., running under the ridge. Two openings are left in the gables at each end for loading. The silage is weighted with a layer of planks, on which blocks of slate are piled. No excavation was required. The walls were built of blocks of stone, set in lime mortar, and are 20 inches thick.

	£	*s.*	*d.*
The cost of lime and carting was	37	19	0
It was lined with cement	5	11	6
Concrete of lime	2	12	6
No drains were put in, but two small taps were inserted	0	10	0
Slate and timber roof cost	37	10	0
Deals and slate blocks for weighting	8	15	0
	92	18	0
Travelling-crane, &c.	3	14	6
	£96	12	6

The whole was most substantially and well built. The weighting was upwards of 140 lbs. to the square foot. The silo was commenced filling on June 22nd, and ended on August 6th. It was begun by putting in half-an-acre of chaffed green oats, then two acres of meadow grass, and, after several days' rest, 2 acres of lucerne, and then finished with a good crop of meadow grass—in all about 12 acres. On our opening it the silage was found to be excellent, and of uniform quality. It was warm, and rather approaching to sourness, and was very pungent. The cattle were fond of it, and as soon as the silo was opened several came across the fields to regale themselves at once. Mr. Darbishire has a covered yard for cattle, and all are fed with silage. He is convinced that he keeps 50 per cent. more cattle on the same acreage with silage as he did when fed on hay. The cost of filling the silos was, in our opinion, excessive, as it came to nearly 2*l*. 3*s*. per acre; but the charge for horse labour we considered was put at too high a figure, viz., 8*s*. per horse per day, but it was explained that that sum was always charged at the adjoining slate quarries, and Mr. Darbishire thought it was fair to charge the same for agricultural work. The fault of these silos was that there were no doorways, or means of emptying them from the bottom, in addition to the great labour of removing the heavy slabs of slate and planking when either filling or emptying, and also the great expense of construction.

Mr. Earle's Silos, at Roby, near Liverpool.—This entry was for a wooden silo erected within a large barn. Length 14 feet, width 11 feet, height

12 feet. It is a simple framework made of timber, the vertical mortised into the horizontal, top and bottom, and braced together at corners with iron braces. The whole sides are lined inside with 1¼-inch boarding, tongued and grooved, and the timber was pickled in a solution of lime, according to Kyan's patent. The boards are screwed on from the inside. The price of the whole, delivered at Roby, was only 18*l*. 10*s*. The floor of the barn was brick and stone already existing. The roof was that also of the barn. The silage was weighted with 10 tons of ships' ballast, at a cost of 45*s*. per ton, and is always worth its money. The silage was not chaffed. The mowing cost 4*s*. per acre, and 4*s*. 6*d*. for hauling, and 2*s*. for filling and treading the silage—in all about 11*s*. per acre. There was in the yard another silo of concrete slabs, covered with Willesden paper, 15 feet by 12 feet, and 10 feet deep. The silo was weighted with stone slabs on planks. There were 31 tons 4 cwt. 3 qrs. of rye-grass and clover put into this silo, which cost 1*s*. 2*d*. per cwt., or 1*l*. 3*s*. 4*d*. per ton, brought from the neighbourhood, and it cost 2*s*. 6*d*. per ton to fill and tread. The silage was excellent, with only a few specks of mould, caused by air having penetrated through some cracks in the slabs. In the silo entered for competition there had been about 6 acres of second-cut clover and rye-grass, and considered to be, after careful weighing, about 47 tons 8 cwt. Mr. Earle has a small but very choice herd of first-class Devons for dairying. They were in excellent condition, very handsome, and were fed on silage, with a small admixture of meal. The dairy and all the appliances were perfect, and after luncheon, at which we tasted the butter, no taste of silage being even perceptible, we pronounced it perfect. Mr. Earle breeds thorough-bred horses. Some mares and foals were shown us, and some remarkably fine cart-horses of great power, which are partly fed on silage. It should be stated that the highest temperature reached in the silo was 165° F., and this went down to 94° F.

The Silo of the Earl of Crawford and Balcarres at Haigh Hall, Wigan.—In the entry paper, No. 1 was stated to be a new silo, 20 feet in length by 15 feet wide, and 12 feet deep, built in the corner of a rick-yard, the sides of which are 5 feet below the natural level of the land adjoining. The floor is 3 feet below the level of the rick-yard, and the walls are 4 feet above the level of the adjacent higher ground. The cost of the silo was 75*l*. 16*s*., including roof (23*l*.). To this must be added 28*l*. 16*s*., for Reynolds's patent pressing apparatus. The amount of 75*l*. 16*s*. was made up as follows:—

	£	*s*.	*d*.
Excavation of 56 cubic yards of earth	1	10	0
Stone and ground mortar 16 inches thick ..	22	12	0
Portland cement lining	8	9	0
2½ inches thick of concrete	3	15	0
Furniture and fittings	16	10	0
Cost of roof	23	0	0
	75	16	0
Pressing apparatus	28	16	0
	£104	12	0

The roof was constructed of timber and iron framework, covered with Willesden paper, the entire roof being run on or off the building by means of 6-inch wheels on iron rails, resting on the wall-plates. The silo was excellently constructed, and the roof simple and ingenious. From the configuration of the ground the silo can easily be filled, and, as a doorway is formed at the

bottom, the silage can be conveniently removed. The silo was commenced filling on June 26th, when 30 tons 11 cwt. were put in, and on the 29th the temperature was taken, and was found to be 115°. No other grass was put in until August 21st, when 9 cwt. was removed damaged, and then 15 tons 11 cwt. more was added; on the 24th, 8 tons 11 cwt. was put in, and on the 25th, 4 tons 4 cwt., and 3 tons 6 cwt. of chaffed oats, just beginning to turn ripe; on the 31st, 3 cwt. was removed damaged, and 4 tons 10 cwt., and 3 tons 12 cwt. of second-cut clover were added, and the silo was filled up to 70 tons by meadow grass. It is now estimated to contain about 58 tons. The silage was good, but we thought the expense too great, and that the mechanical pressure might have been dispensed with. The pressure was supposed to be 179 lbs. to the square foot. We then visited silo No. 2, which was at an off-lying farm, not far distant. The entry paper calls it an "adaptation of an old barn." Length 16 feet 8 inches, by 11 feet 2 inches in width, and 13 feet deep, the floor being 3 feet below the level of the barn, which was 18 feet lower than the level of the ground at the gable end of the building. The soil excavated had been used to raise and form a cartway at the end of the building, and from this cartway the silo is filled through sliding-doors. It is emptied from a door opening on to, and level with, the barn floor. The total cost, including bricks for pressing, was 27*l.* 14*s.* 6*d.*, as there was a roof pre-existing, and the walls of the barn were very substantial.

This was a cheaply formed silo, but there must always be a considerable amount of labour expended every time the silo is filled by the removal and replacing of the bricks and other pressing material, as the weight amounted to several tons. About 8 acres of grass was placed in the silo, which was commenced filling on August 25th and finished on the 31st. About 30 tons was put in, and it is now considered that the material weighs about 25 tons; but the first day it subsided 16 inches, and between Saturday night and Monday morning it sank 2 feet 4 inches. During the past five weeks it has not sunk perceptibly. The greatest amount of subsidence is generally on the first four days. The temperature of this silo was not taken. Mr. Stewart, the intelligent farm manager, says it is undesirable, if you can avoid it, to carry grass in very wet weather, as you are only carrying water, and the men cannot do so much work. The character of the silage was fairly good. Mr. Stewart also says, from actual measurement, they find when green grass is made into good dry hay, it loses two-thirds of its weight. We thought it desirable to go across the park to view a silage stack erected roughly in an old stone pit, and containing trimmings cut from round the trees and shrubs in the grounds, mixed with leaves and sticks, weeds, and sundry other matters usually found in such places; and although all this had been put carelessly together and simply covered with some rough boards and weighted with stones, it contained a good deal of useful food, and was so much relished that a lot of Highland bullocks, which were being pastured near it, ran vigorously down a steep bank, and followed us about eating voraciously all we chose to give them.

Mr. Horrocks Miller, Singleton Park, Poulton-le-Fylde.—This was an adaptation from an old shed, and was 27 feet 3 inches long by 11 feet 9 inches wide, and 11 feet 6 inches deep. The floor was 2 feet below the level of the ground on the outside. The silo was filled from double doors nearly level with the eaves, and emptied from a doorway level with the ground at one end. The cost of converting the shed into a silo was 17*l.* 1*s.* 6*d.*, and the pressing apparatus was Moore's patent, with iron weights, viz., timber beams and planks, which came to 41*l.* 6*s.*; charges for excavating, cement, &c., 13*l.* 11*s.* 6*d.*—in all 71*l.* 18*s.* 6*d.* On September 11th commenced filling, when 11 tons 11½ cwt. was put in; September 18th, 9 tons; 23rd, 8 tons 18½ cwts.; 28th, 9 tons; October 2nd, 1 ton 10 cwts.; in all about 40 tons of second-cut clover, the produce of 15 acres. On opening we found three layers very mouldy, especially

about 1 foot from the bottom, the system of pressure was defective, the silage being generally hollow. The pressure was obtained mechanically by a pair of springs operated upon by a screwed bar working into each of the springs which expands them, producing pressure on the surface, and its continuity is obtained by a clock-weight arrangement, attached to the screw bar by a wire rope with the necessary weights on it. We did not think the principle a good one. The silage was cut and carried immediately, and the cost of cutting, carrying, and putting into the silo was stated to be only 8*l.* 11*s.* 8*d.*, or about 11*s.* 3*d.* per acre.

Mr. Straker's, of Dipton House, Riding Mill, near Hexham, Northumberland.—The silo is formed of a pre-existing building rearranged; it is 17 feet 10 inches long and 11 feet wide, and 16 feet deep. It is filled from windows out of an adjacent loft, through a doorway in a partition wall. The walls are of stone, 20 inches thick, the mortar pointing has been picked out from between the stones, and then covered with best cement, and very smooth to let the silage settle down uniformly. The floor is of cement laid on a covering of stones 12 inches deep. The roof was slated, and no exact cost of the conversion of the building could be given, but the cement cost about 8*l.*; it was very cheaply constructed. The pressure was obtained by the use of chains passing up each side, into the links of which iron levers are put, operating on a plank floor by means of fulcrums placed about a foot from the walls; the levers extend the whole width of the silo, about 10 feet 6 inches long, and are weighted with wheels from an old Crosskill crusher, which acted very simply at a little cost, and much better than any of the patented processes we had seen. There were 18 wheels used, and each weighed 74 lbs. The quality of the silage was uniform and good, and the method of getting it out was easy, as a doorway was provided opening into the yard in connection with buildings where it was to be consumed. It was estimated that about 33 tons was put into the silo from 8 acres of meadow, a rather poor crop. The cost of cutting, carting, and filling was about 14*s.* per acre: commenced filling on July 10th, with 20 loads—the subsidence that night was 19 inches; 11th, 10½ loads, subsidence 5 inches; on the 13th, 10½ loads, subsidence 2 feet 6 inches; in all, 44½ loads were put in. On the 15th, 2½-inch boards were put on, and 8 inches of sand on it—and the total subsidence was 4 feet 6 inches. We were shown in the yard the remains of a silage stack that had been put up roughly as an experiment, and was weighted with bricks. Mr. Straker had been much annoyed in attempting to keep the stack upright, and thought it too difficult to manage for the system to come into general use. Yet he had a quantity of very good fodder, which he admitted was of great value to him, but thought there was too much damage to the outside to make him try it again. He had not seen other systems, which would probably alter his opinion of the advantages of a stack. Mr. Straker is evidently a gentleman who takes the greatest interest in all his farming operations, and is conversant with every detail, which is evinced by extraordinary improvements through planting, and the high state of cultivation which he has produced in a barren country.

Ushaw College, near Durham.—This silo is on the farm premises of the Roman Catholic College at that place; it is described by Mr. Collingwood, the able steward of the College Estate, as being "entirely new;" length 48 feet, width 18 feet, height 18 feet. It is built of worked stone up to 18 feet, and then, on the top, in front and back, of wood, about 2 feet 6 inches between stone pillars. At the back, doors open in two places to admit of filling; and in the front and at the bottom a doorway is placed for emptying; the silo is built in the side of a hill, the bottom of the front level with the other buildings. The cost altogether was about 220*l.*; 150 yards of earth had been removed, the front end walls had gables built of blocks of stone, the silo was lined with cement,

and cost 9*l*. The floor is paved with brick and cement. There are no drains, and it is roofed with Welsh slates; but a well was sunk in the corner, about 1 foot 6 inches by 3 feet, and 1 foot deep; this was full of liquor, none having escaped. There were 33 acres of grass cut and put into the silo from the adjoining fields, as the back of the silo was on a level with the field. The carts were drawn up and their contents easily thrown into the silo. Mr. Collingwood gave us a very carefully compiled statement of the time and quantity of grass put in—

On July	15th ..	25 Loads.
„	18th ..	16 do.
„	20th ..	34 do.
„	21st ..	15 do.
„	24th ..	24 do.
„	30th ..	17 do.
„	31st ..	44 do.
On August	3rd ..	37 do.
„	6th ..	13 do.
„	7th ..	35 do.
„	8th ..	32 do.
„	10th ..	20 do.
„	13th ..	14 do.
„	20th ..	46 do.
„	25th ..	31 do.
On Sept.	1st ..	13 do.
„	2nd ..	28 do.
„	7th ..	11 do.
„	9th ..	6 do.
Loads ..	..	461

It therefore appears that the silo took just 8 weeks to fill, and Mr. Collingwood returns the expenses as follows:—

	£	*s.*	*d.*
33 acres mowing, at 4*s.*	6	12	0
403 loads, at 1*s.* 6*d.*	30	4	6
5 men at 3*s.*, 10 days	7	10	0
	£44	6	6

This seems very expensive, as it amounts to 30*s.* per acre; it was estimated that about 400 tons of silage was made. The plan of weighting was by two screwjacks on beams, which were attached to the bottom of the silo. No earth, bricks, or sand were used for weighting. The subsidence altogether after pressure was about 2 feet. If the silo had been filled to the top there would have been 500 tons in it. The quality of the silage was good, a very little damaged, and the plan for utilising the fodder by removing it at once from the silo into the chaff-house for the cattle was excellent. A large number of milking cows are kept for use of the college, which has upwards of 300 students, and the President, Professor, and educational staff, with attendants, comprising a large number, so that the consumption of the inmates was very great. The sheep were fed last season on the silage, and they ate it voraciously, and did exceedingly well. Mr. Collingwood considers he keeps at least one-third more head of stock on the same acreage by silage than on hay.

Sir John Astley's Silo, Elsham Hall, near Brigg, Lincolnshire.—These

silos were taken off the end of an old brick-built and slated barn, each was 20 feet long, 10 feet wide, and 12 feet high. The silos were built on the floor of the barn, and were filled from the top; the openings at the bottom of each silo were old doors 6 feet 4 inches high and 3 feet wide, and on the frames were wooden slips on the outside, 3½ inches by 1 inch, screwed to the door-frames with 6 screws, which were most effective, and were easily removed. The system of pressure was Stock's patent, and from the spiral springs attached to the screws an even pressure is maintained, and this answered exceedingly well. The cost of the silos was about 28*l.*, and 4 of Stock's patent screws was 30*l.*—in all 58*l.*, or 29*l.* each. There were about 85 tons of silage put into the two silos, and the cost of cutting, carting, chaffing, filling, treading, and putting on pressure was about 25*l.* 3*s.*, or 12*l.* 11*s.* 6*d.* each silo. The material was chiefly long sour grass from under the trees in the park, and had hitherto been wasted; it was mown on July 18th and carted away as it was cut; it was brought to the barn and chaffed by one of Bust's patent chaffing machines with his elevator attached, on which the machine delivered the cut grass; and it was put into the silo, where four men treaded it as it fell from the elevator, and after it was filled 2 feet above the top of the silo the pressure was applied. Three days after filling, and after the material had remained six days, the silo was filled up with second-cut clover not chaffed, and the pressure was put on and kept on until our inspection. The temperature had not been taken until we arrived, and it was then found to be not more than 50° in the silo No. 1 open this day, and it did not appear from the state of the silage that it had ever attained to a higher temperature. The quality throughout was excellent, and on the top of the silo, where a few loads of mixed clover had been placed, it was sweet and aromatic, and the flowers retained their colour in a remarkable manner, the pink and white blossoms being as clear as when put in.

Lord Belper's Silo, Kingston Hall, near Kegworth, Notts.—This was a new structure; length 20 feet, width 12 feet, and height 17 feet. The silo entered for competition was one of four adjoining each other; they were substantially built of brick with tiled roof, and placed closely together adjoining the mixing place; the silo was on a level with the floor, and there was a doorway at the bottom 3 feet 6 inches wide, and 4 feet 6 inches high, which was built up with bricks and mortar, and pulled down when we inspected it. The total cost of this silo was 62*l.* 10*s.*, and we presumed the four together must have cost 250*l.* No mechanical appliance for pressure was used. About 12 acres of grass was chaffed and put into the silo; began cutting and carrying at once on July 15th, 16th, 17th, when those operations were completed. The first day it was weighted with large pieces of coarse gypsum laid on boards, about 1 cwt. to the square foot; there were about 11 tons on the whole. The first day the subsidence was 18 inches, on the second 1 foot, and it gradually subsided to the present height. The temperature had not been taken until this day, when we found it in the centre to be 62°, whilst in the outer air it was 40°, and within 1 foot of the bottom it was 56°. About 70 loads of grass was put in to a depth of 17 feet, and on the day of inspection it had subsided 6 feet 7 inches. The estimated contents were 60 tons, or 5 tons to the acre, according to the statement on the entry paper; the cost of cutting and carrying was about 12*s.* per acre. The quality of the silage was uniform and of good character, and was more sweet than sour; it is almost entirely given to milking cows, which are an excellent lot; no bad taste or smell whatever was given to the milk or butter. The cows in-milk receive daily 30 lbs. of silage and cut straw, with grains and pulped cabbage with rice-meal. The best milkers receive in addition 3 lbs. of decorticated cotton-cake, and 1 lb. of oil-cake. When the cows are milked, their milk is weighed and registered separately.

Messrs. Pochin's Concrete Silo, Croft, near Leicester.—This is described as a new structure, formed of concrete slabs, 4 feet, by 2 feet deep, and 2 inches thick. These slabs are tongued and grooved into each other at the edges, and are fixed by bolts into a framework consisting of standards of wood and iron, part of two of the standards being removable to allow one row of slabs to be taken out to form a doorway for filling and emptying. The roof is made of a simple framework covered with corrugated iron sheets, and capable of being removed by pulleys fixed into the roof-plate and running along a channel of iron. The foundations are fixed into a wooden baulk, let into the ground about 6 inches; no lining is used, as the adamant is smooth; the total cost was 21*l.* 1*s.* The silage was weighted with concrete slabs, similar to the sides of the building, and granite chippings in bags. The silo was not erected until Mr. Pochin had completed haymaking, and he had carted into it a lot of rough grass cut from the hedge sides, with docks, nettles, thistles, and weeds of all sorts. It was filled between August 22nd and 30th; on examination we found considerable damage and waste, and Mr. Pochin considered it much cheaper to make silage than hay, the former costing not more than 8*s.* per acre; his meadows are very liable to flood, and considerable damage has been done by this means. He considers it invaluable for ewes and lambs, producing a better flow of milk, and bringing the lambs earlier to market. His lambs were considered the best of the season in Leicester market last year. He gives one-third silage cut into chaff with hay and straw. His cows have a portion of silage, and no ill-effects have been discovered in their milk. Last year 30 beasts, 160 sheep, and 13 working horses were fed on silage, and all did well, but one horse persistently refused to eat it. The silo was not more than half filled, as there was nothing to be had for filling it; about 13 tons had been put in, and it was computed that there were 11 tons now in. No temperature had been taken, but from a larger silo he found the temperature had risen from 70° to 130°, and then gradually went down to 60°. We saw some silage two years old, made from good grass, which was sour, and in excellent condition; this was from a silo of the same size and construction as the one exhibited.

Silage Stacks.

Mr. C. G. Johnson's Silo Stack.—On November 20th, we visited this gentleman's silage stack at Oakwood, Croft, near Darlington. This was composed of autumn sown tares, seeds, and clover, and old land grass—all put into one stack, which is 19 feet long, 17 feet wide, and 11 feet to the eaves, and 17 feet high to the peak of the ridge. The system of pressing is the "Ensilage Stack press," invented by the exhibitor. The general description of the stack is that it is built in the open air, the top peaked and thatched like an ordinary hayrick; it contains 16 loads of green fodder, and the cost of the press for the 130-ton stack was 18*l.*, which is the selling price. The pressure is obtained by a flexible galvanised iron rope.* Mr. Johnson estimated the cost of cutting, carrying, and pressing the stack at about 18*s.* per acre. In general, the silage was sweet and particularly good; there was a vein of about 2 inches deep across the stack of dark silage—this was after the stoppage on the first Sunday and four following days—and about halfway up the stack a considerable amount of dark silage around the place where the thermometer had been inserted in a tube of boarding 4 inches square, which would not have been the case if a proper tube had been used. There was a space, on the average, of about 8 inches of damaged silage along both sides and ends of the stack; but from the size of the stack and its density we calculated that the waste was not more than about 1½ per cent.

* See last number of the 'Journal,' p. 729.

of the whole. We gave this outside and dark-coloured silage to the cattle, and they ate it freely. We think the whole system excellent and fraught with much value for the future of agriculture. We cut a cube foot from the centre of the stack, and it weighed 64 lbs. Mr. Johnson gave us the record of his diary during the time of his working and filling the stack. It appeared from this record that for some time the temperature varied from 160 to 177 degrees, and fell on August 5th to 165 degrees, in consequence of extra pressure being put on. At the bottom of the stack was a layer of very excellent silage made from an acre of winter vetches, which produced 14 tons of green fodder, and is considered now to be equal to 12 tons of really valuable food for any stock, everything, even pigs, eating it and thriving well upon it. The clover came next, producing nearly 10 tons to the acre, the leaf and flower being wonderfully preserved. The stack was completed with meadow hay, which had turned somewhat dark in colour, but was eaten readily by the cattle. The shape of the top of the stack was arched, and above this was put rough hay and straw, and then thatched in the ordinary manner.

Mr. Reginald Bell's Stack, The Hall, Thirsk.—This was a stack on the same principle as Mr. Johnson's, and we had an opportunity here of personally testing the temperature and learning some interesting details. We think it necessary to mention several points for future guidance in building stacks. This one was 22 feet long and 17 feet broad by 13 feet high, and there were 6 acres of clover, 8 of grass, and 3 of oats and tares cut green. It was thatched with wheat-straw, and the cost of cutting and filling was about 16*s.* per acre. The stack was commenced on August 4th, when 21 loads were put in; on the 5th, 21 loads; it then remained for a week. At first it was 20 feet high; the apparatus was then put on, and the wires were screwed down to about 10 feet; on August 12th, 20 loads of grass were added; and on the 13th, 20 more. This raised it again to over 20 feet high; the pressure was then again put on, and it was reduced to 15 feet. After 5 days' rest, on August 19th, 23 loads of oats and tares were added—in all 105 loads from the 17 acres, or about 6 tons to the acre. The grass was put on to the clover, and after the stack had remained quiet for a week, it was found that the 42 loads of clover had sunk to 3 feet 9 inches, and the 40 loads of grass to 2 feet 6 inches, and the 23 loads of oats and tares occupied 2 feet 9 inches—in all about 9 feet to little above the eaves. There were 20 strands of wire-rope placed about 1 foot apart. The stack was opened on our arrival, and we found about 9 inches damaged along each side and each end; the top and bottom good, although turned rather black in places. The clover was uniformly good, the grass very hot and nearly black, the oats and tares a fair colour. The whole was sweet, with a pleasant smell. On some of the very dark silage being given to the cattle they refused to eat it. We pierced the stack about 4 feet 6 inches, and found the thermometer registered 133°, and in the oats and vetches it was 145°. During the time of building, the temperature, a few days after the grass was put on, was 170°. The compression was excessive, and at one end of the stack, when it was cut, the temperature was 152° on the day of inspection. From the amount of damage sustained apparently by this high temperature, and also by the thatch not being carried sufficiently low down the sides, we considered this stack not so successful as Mr. Johnson's, but its contents showed us that this system could be used to the general advantage of the community. The cost of the apparatus complete was only 15*l.*

Mr. Edward Thornton Blunt, of Blaby Hill, near Leicester.—This is a circular stack 47 feet in circumference, and 14 feet high to the eaves. The system of pressure is from a lever-press supplied by the Ensilage Press Company, Leicester. The material was second-cut clover, and there were about 20 acres of

a very poor crop put on to it. The material was computed to contain not more than 35 tons. The cost of mowing, carting, and stacking with men to press it was about 10*s.* per acre. The stack was built on a few rough loose boards laid across the fulcrum-beams; on the roof were more boards, and the press-beams, with straw on the top, and then it was thatched in the ordinary way. Began mowing on Friday, August 21st, and the weather was so wet that the men left off work, and on the 22nd the waggon load, which was mown on the day before, was tested with the thermometer, and the temperature was found to be as high as 120° in the centre; it was unloaded, and three more waggon-loads were added, and on the Saturday night the stack was 8 feet high. No pressure was put on, and on Monday morning it had sunk 2 feet; on that day 2 loads cut on the previous Saturday were put on, and on Sunday the temperature of the stack was 120°, and on Monday 140°, and up to this time about 13½ tons had been put on to the stack. Nothing was done until Thursday, and the temperature had risen to 150°, and on the 27th, when about 6 tons 10 cwt. were added, the temperature had risen to 160°, and the stack had subsided 3 feet 6 inches before the last loads had been added without weighting; on Saturday the pressure was put on, and at that time the stack was about 8 or 9 feet high; on Sunday the temperature was 160°, and this continued up to Tuesday, September 1st; on Wednesday about 12 tons more were put on. The weighting remained on until Friday, when the temperature was 140°. The stack was completed on Friday, and the temperature continued the same for about a week. The pressure at that time was 100 lbs. to the square foot; it was then increased to 125 lbs. to the square foot, when the temperature fell gradually from 140° on September 4th to 110° on September 22nd. Mr. Blunt's estimate for unloading and stacking seems low, but he says one man can place on a stack of limited area, say about 48 feet in circumference, as much as two men can throw from a load. Practically he has discovered that a silage-stack should be built exactly contrary to an ordinary hayrick, viz., that the sides should be kept highest, and the middle lowest; whereas with a hayrick the middle is always kept filled up. Mr. Blunt says by his system the cost of ironwork for a circular stack of the size we inspected would be not more than 6*l.* 10*s.*, and the boarding on the top extra; but if a larger stack be built, the cost would be less in proportion, in fact the cost would be about 9*d.* per square foot, but this does not include the boarding nor thatching. We weighed a cubic foot of the clover, cut 3 feet from the bottom and 2 feet from the side, and it weighed 50 lbs., it therefore follows that there were about 26 tons in the stack. We found a considerable amount of waste from mould and wet, about 9 inches round the stack being much injured From Mr. Blunt's practical experience he has found, if an acre of good land will produce 1½ tons of hay to the acre, it will give quite 4 tons of silage. There is in this neighbourhood a demand for silage, and he charges 35*s.* per ton for it, the purchaser fetching it away. He says milch-cows will consume about 70 lbs. of silage a-day without anything else, which at 35*s.* per ton would cost about 6*s.* per week; with this amount they will do well, and give more milk than on hay and roots combined. A horse in work will eat 42 lbs. a-day, and with half a peck of oats will do exceedingly well. We also saw a square stack at Mr. Blunt's weighted in the same manner, but this was not for competition. The silage, like the one entered, was extremely good, with much less waste in this than the round one. We also saw some silage of the year before from a silo, which was good but very sour; indeed we were much pleased with our visit to Blaby Hill, and gained much interesting information from so intelligent and practical a man as Mr. Blunt. Had Mr. Blunt entered his square stack instead of the round one, his position in the competition would have been much higher.

This concluded our inspection of the Northern Division, and we are of opinion that the great question of satisfactorily ensiling green crops has received ample confirmation. It has been proved to us, incontestably, that its success has been manifested in every district. We have seen silos of brick, of stone, and of wood; we have seen old barns and other buildings converted into silos; we have seen them sunk into the ground, and built on the level; we have seen them containing 20 tons, and we have inspected others capable of containing 700 tons; we have found silos constructed at a little over 20*l.*, and others at 400*l.*; we have found them filled with all sorts of green crops, and we have found some sour and some sweet—the latter in by far the greater proportion; we have seen them weighted with bricks, with stone, with slates, with sand, with earth, and also with ingenious mechanical contrivances; we have inspected some chaffed, and in others the fodder spread out and put in whole; in all cases the practice was successful, and in every instance cattle of all descriptions did well on the silage, and in many instances the opinion was conclusive that decidedly more stock could be carried per acre with silage than with hay. In one case, Mr. Trepplin had ensiled 900 acres this year, and would make between 4000 and 5000 tons of silage, and should give it to 400 cows, 300 of which are constantly in-milk. But if we say this of the silos, what shall we say of the stacks? Here we find that the practice of ensiling green crops at a very small expense is satisfactorily established, and the system may be carried out at a small outlay, say 12*l.* to 15*l.* for a stack consisting of from 40 to 100 tons. The system of pressure is simple and very effective, and although both to silos and stacks the Judges have awarded certain prizes, yet there are many others of considerable excellence, and nearly all have something to commend them to notice; we think that both silos and apparatus for stacks are desirable, and that both can be used with advantage. In conclusion, we would say that we consider the practice of ensiling will probably affect the future of agriculture on strong land, as in most instances, especially in such where it is necessary to obtain winter fodder for the stock, a crop of winter-grown tares or trifolium, or other strong growing green crops, may be sown in the autumn at little expense, and mown and put into the receptacle by the first week in June, and thus do away with the immense expense and great uncertainty of the cultivation and consumption of roots on such land. We think the silos of Sir John Astley, of Elsham Hall; Mr. Collingwood, of Ushaw College; and Mr. Earle's, of Roby; are worthy of special notice by us. The former, as a good illustration of a portion of barn converted into two excellent silos;

Mr. Collingwood has a well constructed receptacle; and Mr. Earle has a cheap and effective one of wood.

The Final Inspection and Adjudication. By Tom Parry.

(A.) Selected Silos.

Mr. John Morris, Lulham Court, Herefordshire.—This silo is substantially built, and the cost is moderate, being only 14*s.* per 50 cubic feet of capacity.* The ratio of surface-exposure to the bulk of fodder is somewhat high, owing to the very moderate depth of 13 feet. The arrangements for filling and emptying the silo are skilfully designed, for they secure economy of labour. But the system of pressing the fodder is not altogether satisfactory, as with the gradual shrinking of the fodder during the progress of fermentation, the pressure cannot be continuous, without being constantly attended to. This is one of the defects of most mechanical pressures. The appearance of the silage during the preliminary inspection will be found in Professor Long's Report. Dr. Voelcker found the samples taken during the final inspection to be sweet. The second inspection also discovered considerable waste at the sides and the angles, owing to the half-dried condition of the cement-lining of the silo walls at the time the fodder was pitted. It was found, however, that the fodder curved upwards in contact with the sides, showing deficient pressing at those points. The utilisation of this silage was well managed.

2. *Mr. T. Kirby, Hook Farm, Bromley.*—This silo is well-designed, and very substantially built, at the very moderate cost of 9*s.* per 50 cubic feet of capacity. The ratio of surface exposure to the bulk of fodder is very low, owing to the great depth of about 20 feet. The arrangements for filling are very good, but the arrangement for emptying is only fair.† It is to be expected that in a deep silo, filled rapidly, and thoroughly trodden, the silage would be acid. Mr. Kirby is of opinion that this acidity favours the purpose he has in view, namely to force the utmost amount of milk from the herd of about 130 cows, which he constantly feeds. It is impossible not to admire the effective and economical management at this farm. The feeding is very economical, and the skilful management of labour is equally effective.

3. *Mr. W. J. Harris, Halwill Manor, Devonshire.*—This silo may be termed a compound one, the iron roof being built so high, that it affords shelter for both corn-stacks and sheep.

* For details see pp. 271–275. † For details see pp. 264–266.

The cost cannot very well be reduced to the unit adopted in the other cases, as it is impossible to apportion the items between the silo proper and the covered stack- and fold-yard. The corn-stacks are built on the filled silo.* The Judges doubted very much the practicability of this system, both as regards the corn and silage. The arrangements for filling and emptying are excellent. The utilisation of the silage was well-managed, though there was much waste in the oat-silage.

4. *Mr. C. F. Trepplin, Kenilworth.*—This silo is large, without divisions, and of great depth. The cost of making it is reasonable enough. The roof was observed to be not very substantially built. Neither the arrangement for filling nor for emptying is of the best description.† The management, however, is praiseworthy. Whether it is more economical to have the silo without or with divisions, must depend in a great measure upon the size of the farm, and the special circumstances attending each case.

5. *Mr. W. H. Collingwood, Ushaw College, Durham.*—This silo is most substantially built, and secures excellent arrangement both for filling and emptying. The cost, however, is rather high, being 14*s.* per 50 cubic feet of capacity, arising, no doubt, from a desire to have the new structure in harmony, as to outward appearance, with the expensive farm-buildings adjacent to it.‡ The mechanical pressure used for compressing the fodder was cumbrous in its application. It is proposed in future to use no pressure but that of the fodder itself, and that of the men treading and ramming the sides while the silo is being filled. It is probable that in this climate, and especially so when the fodder is carried during showery weather, that this mode will be found effective. But it is very doubtful whether it pays any one to drive off moisture from the silo at the expense of the oxidation of part of the dry substance of the crop. Whether the advantage of keeping the men at work, even in showery weather, will balance this loss must be left to each person to decide for himself. The silage was found to be decidedly acetic. The amount of waste at one of the rounded angles might be less, had more care been taken to press and ram the fodder at these points.

6. *Mr. James Howard, Clapham Park, Bedford.* — Mr. Howard's silo is very substantially built, but is decidedly expensive—28*s.* per 50 cubic feet of capacity. The arrangements for filling and emptying the silo are excellent.§ Mr. Howard claims that his system perfectly controls the fermentation by an

---

* For details see pp. 278–282.

† For details see pp. 288–290

‡ For details see p. 293.

§ For details see p. 262.

air-tight silo, obtained by the edge of the roof or lid being made to descend into a trough containing a little water. Mr. Howard says:—"The result is the uniform production of sweet silage, *i.e.* a silage with the least degree of change from the condition of the green crop. Experience with the Howard silo, on the large as well as the small scale, has proved this result to be constant. The material does not practically alter in condition after the oxygen originally stored with it has been exhausted by fermentation." It is true that Mr. Howard's clover silage was excellent in all respects: but the Judges were of opinion that it would be easy for any system to produce good silage from a crop only amounting to 2 tons to the acre in the green state, and containing only a minimum quantity of moisture. But the maize silage contained ·42 per cent. of acetic acid and ·52 per cent. of lactic acid. So far, therefore, as the maize crop is concerned, Mr. Howard's system fails to secure "sweet silage with the least degree of change from the condition of the green crop." During the first inspection the upper layer of silage was found to be saturated with moisture, owing to the condensation of vapour in contact with the inside surface of the iron roof. A long pipe-like fungoid growth was also observed in one of the angles. The amount of water in the maize was over 84 per cent., even after the roof had on several occasions been lifted to get the silage out, and so exposed to the drying influence of the atmosphere. If we compare the maize silage of Mr. Howard with that of Mr. Brassey, it would appear that free exit for vapours generated during the fermentation of the fodder is favourable to the formation of lactic acid. Although Mr. Brassey's silage contained 86 per cent. of water, it had only one-half of the quantity of acetic acid and much more of lactic acid than the amount found in Mr. Howard's silage. Notwithstanding the excellent quality of the clover silage, the Judges could not take the responsibility of highly commending this system.

7. *Mr. H. A. Brassey, Preston Hall, Kent.*—Mr. Brassey's silo is of excellent design, and substantially built, but at the great cost of 35*s.* per 50 cubic feet of capacity.* A greater depth in the silo would secure storage capacity at very little additional cost, while the surface-exposure in comparison with the bulk of fodder would at the same time be reduced. The arrangements for filling and emptying are excellent. The silage was found to be decidedly acid. The waste was considerable, arising partly, no doubt, from Mr. Brassey's desire to give a fair trial

* For details see pp. 262–264.

to several mechanical systems of pressing. Less waste was found where dead weights were used. During the second inspection the utilisation of the contents of the silo appeared to be half-hearted. Whether this was due to the distance of the silo from the homestead, or to other causes, is not known.

8. *Mr. F. W. Earle, Edenhurst, Huyton, Liverpool.*—Mr. Earle's silo is constructed of wood, at a moderate cost of 10*s.* per 50 cubic feet of capacity.* It is an important question, however, to know the probable duration of wood in comparison with stone or bricks for such purposes. The filling here is rather expensive, as the fodder has to be lifted about 12 feet; unless the barn-door was made large enough to admit of the loaded carts being drawn alongside the silo; the emptying would be done at the floor-level. The pressing would be laborious on this system. The silage here was sweet and of an excellent quality, and delightfully fragrant. At about four feet from the floor-level a layer of silage was noticed of much darker colour, and containing more moisture; this, on analysis by Dr. Voelcker, was found to be decidedly acid; but the bulk of the silage was sweet throughout.

The utilisation of the silage on this farm was very judicious; but the treading of the silage at the corners in filling the silo had not been thorough, resulting in considerable waste at these points. The ramming of the sides was especially desirable here on account of the partial dryness of the crop previous to pitting. This extra labour has been incurred in consequence of the complaints of the neighbours in previous years, that the strong smell of the acid silage caused them great inconvenience. Hence Mr. Earle's determination to secure sweet silage by getting rid of part of the natural moisture of the crop. He considers now that the change has been advantageous both to his neighbours and himself.

The particulars of the feeding for milk-production at this farm are given on page 304, for the purpose of comparison with Mr. Kirby's ration (p. 265), which contains *acid* silage. The amounts are per head per day; the cows being well-bred Devons.

It is seen that there is a great deficiency of fat in this ration as well as in that of Mr. Kirby's, and a large excess of carbohydrates, amounting to 9 lbs. per day per cow. It would not serve any purpose to carry this analysis much further, as we do not possess any data of the yield of milk or of its composition. The albuminoid ratio is as 1 : 8, which is too high for cows in-milk, the standard being about 1 : 5.

---

* For details see pp. 290–292.

	Dry Substance.	Digestible Nitrogenous.	Digestible Carbohydrates.	Fat.
	lbs.	lbs.	lbs.	lbs.
30 lbs. silage (sweet) containing .. .. (= 60 lbs. mangolds)	18·0	1·26	10·46	·115
10 lbs. oat straw "	8·6	·13	3·74	·06
20 lbs. swedes "	2·5	·22	1·82	·02
4 lbs. meal "	5·72	·42	2·04	·12
	34 82	2·03	18·06	·315
Required for 1000 live weight (sustenance)	..	·7	8·	·15
		1·33	10·06	·165
Required for 20 lbs. milk (13 per cent. solids)	..	·8	·92	·74
Excess (+) or deficiency (−) in food		·53 (+)	9·14 (+)	·575 (−)

9. *Sir John Astley, Bart., Elsham Hall, Lincolnshire.*—This silo is not a new structure, but has been formed out of one of the bays of an old barn.* The cost of the conversion has been 12*s.* 6*d.* per 50 cubic feet of capacity, which is expensive. The filling is laborious, the emptying, however, being at the floor-level. The silage was found to be decidedly acid. The treading at one angle had been defective, with considerable waste as the result. The mechanical pressure used was expensive, and rather laborious in its application.

(B.) Silage Stacks.

The two stacks left for second inspection were built and pressed by the same system, which was invented by Mr. Johnson. The silage in both cases was excellent in quality. The Aylesbury Dairy Company's stack had a little more waste at the sides than Mr. Johnson's; but, on the other hand, Mr. Johnson's stack had more waste on the crown or "peak." It is only fair to say that the merits of the two stacks were nearly equal.

(C.) The Award.

(*a.*) *Silos.*

The Judges recommend that the Prize of 100 Guineas be awarded to Mr. J. Morris, Lulham Court, Madley, Herefordshire.† They also recommend to the special consideration of the Council the silos entered for competition by Mr. W. J. Harris,

* For details see p. 295.

† A certificate to this effect has been awarded by the Council to this competitor.

of Halwill Manor, Highampton, Devon; Mr. T. Kirby, of Hook Farm, Bromley; and Mr. C. F. Trepplin, Kenilworth, Warwickshire.* The Judges have pleasure in adding that several other competing silos presented features of excellence, which have been duly described in their Report.

(*b*.) Silo Stacks.

The Judges award the Prize to Mr. C. G. Johnson, of Oakwood, Croft, Darlington; and highly commend the Aylesbury Dairy Company's stack, constructed and pressed on the same system.†

As the result of their inspection the Judges have come to the conclusion that the stack system of preserving green fodder has already been successfully carried out, and is capable of considerable extension on account of its great economy and the excellence of the results obtained.

(Signed) G. W. Baker.
J. K. Fowler.
James Long.
Thomas Rigby.
John Wheatley.
Tom Parry.

VI. Notes on Ensilage.

(1.) *The Cost of Silos.*—This will range between wide limits, according to their size, depth, and the materials used in their construction, and to the price of labour. If the stones, bricks, concrete, wood, &c., can be transported with little labour to the site of the silo, the cost for a moderately large structure ought not to be much more than 10*s.* per 50 cubic feet of capacity. But this, of course, supposes skilful and efficient management on the part of the farmer. The variations in cost will be found in Tables I. and II., p. 306. The information will be found useful by those who intend to build silos in the future.

(2.) *Crops for Silage-making.*—If the Rothamsted experiments are to be trusted, the clover crop suffers much less change and loss while in the silo than meadow-grass. But good silage can be made easily from meadow-grass, rye-grass, trifolium, oats, vetches, &c. The crops, however, ought to be cut just before they are ripe, as at that period the nutrients of the fodder will be more equally distributed throughout the whole structure of the plant.

* Silver Medals have been awarded by the Council to these competitors.

† Certificates to this effect have been awarded by the Council to these competitors.

TABLE I.—COST OF NEW SILOS.

NAME.	Materials used in Construction.	Total Capacity, Cub. Feet.	Cost per 50 Cub. Feet.
			£ s. d.
Morris	Stones, bricks off estate—M. P.* ..	7,020†	0 14 9
Kirby	Concrete walls—Slate roof—D. W.‡	23,750	0 9 0
Brassey	Concrete walls—Iron roof—M. P. and D.W.	11,050	1 15 0
Collingwood ..	Stones, Slate roof, M. P.	15,550	0 14 0
Howard	Bricks, Cement, Iron lid	2,450	1 8 0
Earle	Wood and D. W.	1,850	0 10 0
		6)	5 10 9
	Average		£0 18 6

* M. P. = Mechanical Pressure.
† Capacity of super-silo 3,780 cubic feet.
‡ D. W. = Dead Weight.

TABLE II.—COST of the best SILOS in the WESTERN DISTRICT per 100 cubic feet.

NAME.	Capacity, Cub. Feet.	Total Cost.	Cost per 100 Cubic Feet.	New Structures.
		£ s. d.	s. d.	
Morris	7,020	102 18 8	29/5	Supersilo 3780 cubic feet extra.
Elwes				
Rapsgall silo	3,348	15 9 6	9/3, 4/7½	Built across the end of a barn.
Penhell ..	5,143	18 9 1½	3/7	Ditto ditto.
Harris	28,224	542 0 0	19/2½	Covered space overhead 96,000 cubic feet at 20 feet high—new structure.
Hellier	2,880	34 15 0	12/1	Wood—new building.
Tanner	5,163	93 0 0	18/0½	Built in a covered yard.
Ld. Wolverton's				
Church Hill	12,960	280 8 3	21/7	New building.
Hill Barn ..	6,023	111 3 6	18/5	Built across the end of a barn.
Ward and Lawry ..	3,300	87 0 0	26/4	Covered space or supersilo, 3000 feet.
Martin	3,780	37 15 10	10/–	A new building built against the outer wall of an old one.
Cornish	8,000	108 8 7	13/6	New building.

(3.) The cost of cutting, loading, carting, filling the silo, and pressing the fodder, is of more practical value to the farmer, but the Judges are not in a position to give any positive opinion on the subject.

(4.) *Pressing the Silage.*—The Judges throughout their journeys were very favourably impressed with the economy and efficiency of pressing by dead weights;—notably in those places where there was dry soil or sand to combine in itself the two

points of successful pressing and an excellent covering to the silage. Blocks of concrete or iron, or bags of sand, &c., are also used with success, but these require planks or boards over the whole surface of the silage, so as to equalise the pressure. Yet it was doubtful whether the surface equalisation of pressure was so well secured by these weights as by loose soil or sand. And further, this board-covering was not nearly so efficient as the soil. It was surprising to see how the soil-covering did not bring about any waste in the silage.

The mechanical pressures were often laborious in their application and inefficient in their results. The best under control—similar to that used in Mr. Morris's silo—was that of Mr. Wilson's, at Rigmaden Park. By skilful use of levers, the pressure was made to follow the shrinking of the fodder between the periodical pressings by means of a hydraulic jack. Hence the importance of thoroughly treading the fodder, and especially of ramming it near the walls, where the atmosphere is most likely to force itself in, and to work the decomposition of the fodder by degrees. The golden rule of silage-making is—look to the consolidation of the sides, and the centre will look after itself.

(5.) *Acid or Sweet Silage? Chaffed or Unchaffed?*—The theory of silage-making has been greatly elucidated by the experiments carried on by Mr. George Fry, F.L.S. To those who wish to understand the question, we highly recommend the study of Mr. Fry's little book on "Sweet Ensilage." * For the purpose of this Report, it is sufficient to point out the physical conditions of the fodder while in the silo, that appear to be favourable or otherwise to the various fermentations. If we refer to Table III. (p. 308) and notice the amount of acidity in the crops that are chaffed, and of those that are ensiled unchaffed, we notice the average percentage of acidity in *chaffed* silage to be ·27 per cent. of acetic acid, and ·72 per cent. of lactic acid.

The greater the depth, and the greater the moisture in the crop, other things being equal, the greater will be the tendency to produce acid silage, as these conditions would be unfavourable to the development of sufficient temperature to destroy the life of germs of ferments present in the fodder. Hence the great development of acidity in Mr. Kirby's and Mr. Collingwood's silos. That the great variety in the circumstances attending the silage-making given above may not tend to make the results obtained as to acidity unsatisfactory, we will give the

* 'The Theory and Practice of Sweet Ensilage,' by George Fry, F.L.S.; The Agricultural Press Co., Clement's Inn Passage, Strand, London, W.C.

TABLE III.—CONDITIONS OF

NAME.	Silo Covered.	Time taken to Fill.	Weather when Pitted.	Depth of Silo in ft.	Crop.	Chaffed or Unchaffed.	Maturity.
Morris ..	28 July	14 days	Superb	13′	Oats and Grass	Unchaffed	Full bloom
Trepplin ..	18 Aug.	30 „	Partly fine and showery	18′ 6″	Clover	Unchaffed	Rather over-ripe
Howard ..	2 Oct.	16 „	Fine Damp	17′	Clover Maize	Unchaffed Chaffed ..	On the head .. Just coming into head ..
Astley ..	29 July	13 „	Fine	12′	Grass Clover	Chaffed .. Unchaffed	Fully ripe
Collingwood	9 Sept.	56 „	Wet as a rule	18′	Grass 2nd Clover	Unchaffed	Ripe and over-ripe
Kirby ..	24 June	14 „	Very fine	20′	M. Grass	Unchaffed	Full bloom
Brassey ..	22 July 7 Oct.	2 „ 2 „	Fine Showery	12′ 12′	Oats Maize	Chaffed ..	In ear .. In bloom and cob
Earle ..	16 Oct.	46 „	Fine	12′	2nd Clover	Unchaffed	Fully ripe
A. D. C. ..	26 June	14 „	Fine gen.	75 tons abt.	Trif. ..	Unchaffed	Full bloom
Johnson ..	30 July	30 „	Fine	120 „	Tares, Seeds, M. Grass	Unchaffed	Little over-ripe Full bloom Full bloom

PITTING, AND RESULTS.

Kind of Pressure.	Opened.	Period Sealed.	RESULTS. Water.	Acetic Acid.	Lactic Acid.	Remarks.
Men and horse treading + Mechan. P.	12 Nov.	107 days	69·6	None	None	
Men, horse, and little loose earth for covering	30 Oct.	73 „	61·8	·07	·14	
Only trodden by 3 boys, and rammed by man	11 Nov.	40 „	69·60 84·58	None ·42	None ·52	
6 men + Patent screw	23 Nov.	117 „	74·5 69·9	·22 ·14	·87 ·11	Av. of 2 samples.
3 men treading, + Mech. P.	19 Nov.	71 „	78·19 74·55	·21 ·25	·42 ·21	
Men, horse + 1 ft. soil for covering ..	18 Nov.	147 „	70·72	·25	·73	
3 men + Mech. P.	12 Nov.	113 „	68·36	·24	·78	
3 men + D. W. ..		36 „	85·99	·21	·69	
2 men + 1 woman + $1\frac{1}{3}$ cwt. per sq. ft.	30 Dec.	75 „	40·41	·39	1·73	Exceptional—bulk of silage sweet.
Ordinary treading + Mech. Pressure	14 Nov.	141 „	74·78	·42	·63	
Ordinary treading + Mech. Pressure	1 Oct.	61 „	70·60 67·60 71·49	·14 ·08 ·11	1·58 ·14 ·21	

case of the oat-crop ensiled by Mr. Morris and Mr. Brassey. In Mr. Brassey's case the crop was *chaffed*, and was found to contain ·24 per cent. of acetic acid and ·79 per cent. of lactic acid; while Mr. Morris's oat-silage *unchaffed* gave no acetic acid or lactic acid. It is therefore not unlikely that chaffing enables the ensilor to consolidate his fodder to a greater degree than otherwise, and so to reduce the quantity of air in the bulk of the fodder, and consequently the amount of oxidation with its accompanying elevation of temperature. Hence, if the conditions attending the crop in the silo, such as heavy pressure, large percentage of moisture, &c., be unfavourable to the development of rapid temperature, the tendency will be to produce acid silage. Mr. Fry states that the principle of sweet silage is to let the temperature rise to about 122° Fahrenheit, or 50° Centigrade, throughout the bulk of the fodder.

(6.) *Silage as food, with its cost per ton.*—Without entering into the complicated question of the chemistry of silage-making, or of the fermentations of the silo, it will be sufficient to state briefly what is definitely known of its effects in feeding stock. The Rothamsted silage, containing about 75 per cent. of water, was tested against mangolds, when 50 lbs. of the silage was found equivalent to about 84 lbs. of the mangolds. The silage was more effective in laying on fat, and the mangolds were more favourable for milk-production. These experiments of Sir John Lawes have clearly established the great value of silage as food, and have thrown a flood of light on the changes that take place in the silo, enabling silage-makers to base their calculations on scientific certainties.

(7.) *The economy of Silage-making.*—This, after all, is the crucial point to be determined, either by special experiments in silage-feeding, or by the combined experience of its use by farmers throughout the country. The object of farming generally is to obtain the largest amount of digestible nutrients at the least cost, and also the least injury to the soil. There can be no doubt as to the economy of silage-making in localities where it is difficult or risky to make hay, or where good crops of roots cannot be grown regularly. But in other localities, where good hay and roots can be secured, it is doubtful if this process will supplant the root-crop, which enables the farmer to keep his land clean, and therefore in good condition to grow large crops of corn and "seeds." The chief advantages of silage-making against hay-making is its comparative independence of the weather; that the fodder is handled while green, without any risk of the tender and nutritious leaves being lost on the ground as in hay-making; that the resulting silage is succulent and palatable; and that on purely grazing farms it is now pos-

sible to obtain a portion of the grass crop for winter use in such a state as to equal the effect of summer-fed grass for the purposes of the dairy.

It remains for the Judges heartily to congratulate the Council of the Royal Agricultural Society of England in that a marked success has attended their competition for the best systems of preserving fodder crops. May the British farmer generally reap the benefit which results from contests of this kind! Our thanks, as Judges, are expressly due to the competitors and their agents, for their invariable hospitality and readiness to give information for the purposes of this Report. We were often struck by the enterprise and skill displayed by most of the competitors. This should make us hopeful for the future of British farming.

IX.—*Report of the Consulting Entomologist of the Royal Agricultural Society for* 1885. By Miss ELEANOR A. ORMEROD, F.R.Met.Soc. Dunster Lodge, Spring Grove, Isleworth.

I BEG to submit, as a summary of the work of the present year, a list of the crop insects regarding which enquiry has been made, with a few remarks as to points newly brought forward.

Attacks noticed have been—

To Corn or Grass.—Aphides in unusual numbers; and, on oats as well as wheat, corn thrips, red maggot of two species, wire-worm, but this last not as much reported as in some previous years; daddy long-legs grubs, millipedes, or false wire-worms (these are not true insects); antler moth caterpillars over an area of about seven miles by five in Selkirkshire; the small chafer beetle, sometimes known as the field or garden chafer, *Phyllopertha horticola* (of which the maggots are very destructive to grass roots), in a flock of many thousands on a potato field near Northwich, and also the caterpillar of the "Small Swift Moth," which is sometimes very injurious to the roots of grass as well as to various kinds of root crops in the spring.

To Mangolds.—Black aphides, popularly mistaken for the collier or bean aphis, mangold maggot slightly reported, millipedes, and, likewise, observations with accompanying specimens, of the attack of the *Steropus madidus*, a nocturnal feeding beetle, previously believed to be only carnivorous.

To Beans and Clover.—Aphides on beans, and attacks of Sitonas, commonly known as pea, bean, and clover weevils, in the beetle state to the bean leafage, and in the grub state to clover roots.

To Turnips.—Aphides; serious and widespread attack of turnip moth caterpillar, accompanied by one or two allied kinds. Likewise the grubs of the *Bibio Marci* (manure feeders, much resembling small Daddy Long-legs grubs), which were found at the roots of cabbages, and "Snowy Fly"—*Aleyrodes*—(an insect which in its early stage much resembles "Scale Insect") on cabbage leaves.

Hop Aphis, Mustard Beetle, Cockchafer, and other regular pests have, of course, been matters of correspondence.

With regard to fruit attacks, enquiries have been made regarding—Red maggot in pears; the web-spinning caterpillars of the small ermine moth on apple trees; and the hairy, red-tubercled, and whitish-tufted caterpillars of the vapourer moth, which are very destructive to leafage of various fruit trees; the *Phytoptus*, a minute gall midge, sometimes seriously injurious in fruit farming by causing the growth of swollen abortive buds on the black currants; also the gooseberry or magpie moth, and the gooseberry sawfly. Amongst forest or timber insects, communications have been made regarding attacks of the great goat moth caterpillar, which is injurious to most of our deciduous timber and fruit trees; the elm-bark beetle; the leaf-roller moth-caterpillar of the oak; and also the large purple-and-green fork-tailed caterpillar of the puss moth, which appeared on poplars in two localities in Forfar. Attacks of the *Sirex Juvencus*, sometimes known as the "wood wasp," of which the grubs live in fir timber, and of *Larch Aphis* (a serious pest in larch plantations), were also reported.

Many serviceable communications have been sent regarding Ox Warble Fly, of which I have already submitted a portion regarding the development of the Warble and Maggot. The observations, which give much useful information, especially as to methods of killing the maggot by applications which cannot do harm in the most careless hands, will be given at length in my own next Yearly Report on Injurious Insects. I am also at present collecting evidence as to the presence of Warble maggot in the human subject, which may throw some light on the nature and amount of pain suffered by cattle attacked.

With regard to some of the more special points of the attacks of the year, one of these was the great amount of presence of corn aphides or plant lice. It is somewhat remarkable that, though a trustworthy description of attacks of what was obviously the true corn aphis (the *Siphonophora granaria*) was sent me from Kingsnorth, Kent, hardly any specimens of this species appeared to be present on any of the large number of infested ears sent to me for examination, mainly from the more northerly parts of England. These aphides, in all their successive stages,

were commonly of such a full deep brown, that the correspondents described them in the mass on the ear as black, and the ears as if attacked by smut. This attack affected oats as well as wheat much more than usual, and corresponded much more with the brown variety of the *Aphis avenæ*, as given in Curtis's Farm Insects than with any other description I am acquainted with. The blackish aphis on mangolds was forwarded for examination under the impression that it was a spread of bean aphis or collier on to yet another crop, but I can say with certainty that the specimens sent were not of that kind. A very variable kind much resembling the collier, known scientifically as *Aphis papaveris*, infests mangolds, and another, the *Aphis atriplicis*, infests orache and plants allied to mangolds. From want of specimens I cannot say with certainty how far the Mangold attack generally was produced by these two kinds, but assuredly as far as what was sent went, there was no "collier."

Towards the end of the autumn, the enormous proportion of aphides which had been destroyed by parasitic flies on some of the turnip leaves sent to me was very remarkable, more than three-quarters having thus been killed. This is satisfactory in having got rid of a great quantity which might have caused further trouble presently.

Two kinds of red maggot were forwarded together from threshings of "Essex Wonder" wheat. The common kind (taken from this wheat) was in greater numbers than I have ever before seen it, though Golden Drop wheat near it was comparatively free. The species sent accompanying it was much larger and of more solid make, and of a vermilion or pale red-lead colour, corresponding with the description of the barley midge maggot (*Tipula cerealis* of Sauter). This feeds on the leaves or stems of different kinds of cereals, and goes down into the ground to pass through its changes. It sometimes does much mischief by causing a distorted growth of the straw, and the best method of preventing repetition of the attack is to skim the surface of the infested field as soon as possible after cutting the corn, and drag the stubble into heaps and burn it. Thus, the maggots which remain, as I have seen on Rivett wheat, will be destroyed, as well as those that have turned to pupæ, and such as are thrown to the surface will be pretty well cleared by the insect-eating birds which frequent corn-fields in the autumn, unless these are driven away by the universal bird-pest, the sparrow.

The communications of the year have shown still more plainly than before the loss that this bird is causing. A large body of evidence has been brought before the public in the

United States, as to the damage the sparrow is causing by driving away useful birds, as well as by its own voracity; and I have recently been informed by Mr. I. A. Lintner, State Entomologist of New York State, that a society has been formed in New Jersey, which offers a bounty for sparrows' heads. In South Australia, also, measures are being suggested to keep them in check, for there, as elsewhere, it is not only the personal attacks of these birds on all that they take a fancy to that is injurious, but the driving away of true helpers.

Members of the Wirrall Farmers' Club, who occupy land which is quite in the country, report that, with the help of their Sparrow Club, they have not been so free from these pests for a long time as at present; where land lay near large towns it was found impossible to check attack. To all who consult me on the subject, I most strongly advise that they should do their best by every possible means, save such as would involve the infraction of the law in close time, to get rid of these injurious birds.

The remaining chief point of the observations of the year has been the very serious amount of attack of turnip caterpillars, mainly those of the common turnip-moth *Agrotis segetum*. This attack has been reported from eleven counties, and has caused much loss. Sometimes as many as twenty of these caterpillars were found at one root. None of the applications which have been tried to clear these grubs—as of lime, salt, sulphur, or soot—have proved of use, as far as has been reported; but both in the States and in this country it has been found that caterpillar attack was either not present, or was lessened in amount, where land had been well salted during previous cultivation. The only remedies which have been found of use have been much hoeing and thorough disturbance of the surface-soil, when these surface caterpillars appear early in the year; likewise hand-picking by turning them out from the roots, which is a tedious, though reliable, cure so long as the condition of the crop admits of it. When a crop has been destroyed, the grubs which remain may be much cleared by turning on pigs to root them out, and by skimming the surface in bad weather, such as alternate frost and thaw. It is of great importance to get them destroyed on infested land, as they otherwise probably survive the winter, and continue their ravages in spring.

I have pleasure in being able to state that serviceable attention to prevention of loss by insect ravages is being increasingly directed to the subject, not only at home, but in various parts of the British possessions, regarding which communications are addressed to myself as your Entomologist.

In the present year I have written more than 400 letters entirely relating to farm attacks in Great Britain and Ireland (I did not begin to keep an exact account until the 10th of April, therefore cannot state the number precisely). There has been also a very large amount of correspondence on allied subjects (especially regarding means of obtaining instruction or information), and also communications with public bodies.

I may especially mention, that by desire of the Committee of Council on Education, I have undertaken to superintend (as far as my other duties allow) the rearrangement of a portion of the valuable collection illustrative of injurious insects and their ravages, known as the "Collection of Economic Entomology" at South Kensington, with the view of making it of practical service to farmers and all interested in the matter. By placing the pests of the various crops, cattle, &c., respectively together, in cases distinguished by the English name of the crop or animal attacked, I believe the large collection will become of great public service, and I may add that a portion of the rest of the work is in the skilled hands of Professor Westwood.

In regard to British possessions there has been much Colonial correspondence. At present, considerations have been set on foot regarding the collection of information relating to some crop pests of India, about which I submit a part of the correspondence which has been published by the direction of the Secretary of State for India. Also at Port Elizabeth, South Africa, work is in progress regarding the crop pests of that district of Cape Colony. The collection of specimens and information upon them are to be forwarded to myself for illustration and publication.

I am also in business communication with the Entomologist of the Department of Agriculture of Canada, and there has also been correspondence with other British Colonies, and with the Entomologists of the United States, &c., &c.

I should like to be permitted most respectfully to suggest that the public service is suffering much from the need of more workers or available referees, who have a knowledge of the requirements of the farm treatment, as well as of the names, and in some degree of the habits, of crop and cattle insects.

X.—*Annual Report of the Consulting Chemist for* 1885. By J. Augustus Voelcker, Ph.D., B.Sc.

During the year the number of samples submitted to me for analysis on behalf of members of the Society has been 1587, or 41 less than in the previous year. The examination of these samples, and the Quarterly Reports to the Chemical Committee, show the increasing desirability of purchasers of artificial manures, feeding-stuffs, &c., taking advantage of the privileges afforded to them through the Society's laboratory. The continued depression in agriculture and trade generally, while it has cheapened to a considerable extent the prices of foods consumed, and of manures used on the farm, has also had the effect of bringing forward a number of materials, often of but slight or no intrinsic worth, of which the only claim for merit is their seeming cheapness. Farmers are often tempted by a low price to buy that which is in reality a very dear bargain, whereas at no time should more care be taken to ensure the obtaining of what is really worth its price. The special features that have marked the year have been the general low prices of artificial manures of all kinds—that of sulphate of ammonia being most noticeable,—the improvement of the quality of linseed-cakes, together with a lowering of price, and the deterioration in the quality of decorticated cotton-cake.

The continuation of the Woburn experiments, and the increasing interest manifested in the subject of Ensilage, have, in addition to the ordinary analytical work of the Laboratory, engaged my time and attention.

Linseed Cakes. — As in previous years, a large number of feeding materials have been sent for examination, and of these linseed-cakes have been the principal ones. I am happy to be able to report that there has been a decided improvement alike in the quality and the purity of linseed-cakes; and although it has been my duty to report a number of cases of inferior and adulterated cakes, yet the proportion of really first-class and of quite pure cakes has been much higher than before. The thin and hard-pressed American cakes, to which attention was called in last year's Report, do not appear to have been so largely used; and as the price of good English cake has more nearly approximated to that of the American cakes, so has there been a better demand for the former. It is only fair, at the same time, to mention that I have this year examined several samples of American linseed-cake, which, though appearing to be somewhat hard pressed, and probably poor in oil, have, on analysis, proved to be quite otherwise. As instances I give the following:—

	No. 1.	No. 2.	No. 3.	No. 4.
Moisture	9·28	9·48	12·02	12·38
Oil	11·60	13·77	13·83	11·20
*Albuminous compounds	34·19	29·69	29·69	32·39
Mucilage, &c.	31·75	32·85	33·70	31·47
Woody fibre	7·90	8·57	5·87	7·57
Mineral matter	5·28	5·64	4·89	4·99
	100·00	100·00	100·00	100·00
* Containing nitrogen	5·49	4·75	4·75	5·18

On the other hand, there have been many American cakes containing but a very low percentage of oil: for example:—

	No. 1.	No. 2.	No. 3.
Moisture	7·15	14·01	9·73
Oil	5·93	6·07	5·86
*Albuminous compounds	38·44	24·66	26·25
Mucilage, &c...	33·40	40·62	41·21
Woody fibre	8·13	8·17	10·26
Mineral matter	6·95	6·47	6·69
	100·00	100·00	100·00
* Containing nitrogen	6·15	3·95	4·20

No. 1 cost in December, 1884, 8*l*. 5*s*. per ton on rail, which was about the average price of the cakes given in the former Table of richer cakes. The great difference between these two sets of analyses of American cakes leads me to remark upon the impossibility of judging with any certainty whatever of the relative qualities of cakes when only a superficial examination of them is relied upon.

Of materials used to adulterate linseed-cake, or not properly removed by screening, the principal ones detected have been locust-bean, niger-seed, cotton-seed husk, rape, polygonum, rice and other starchy bodies, and fine dust or sand. In two cases castor-oil bean has been detected, in each instance the cake containing it having proved fatal to stock feeding on it. The percentage of sand or dirt has in several cases been very considerable, and is then, I consider, apart from the question of deterioration in the actual value of the cake, highly objection-

able as regards the health of stock. The following are cases in point:—

	No. 1.	No. 2.	No. 3.	No. 4.	No. 5.
Moisture	11·56	10·77	12·06	11·21	10·48
Oil	11·73	7·50	7·67	12·83	9·07
*Albuminous compounds	26·25	7·44	21·69	26·01	24·01
Mucilage, &c.	29·49	32·99	36·89	31·04	35·24
Woody fibre	7·97	8·33	10·53	7·40	10·57
†Mineral matter	13·00	12·97	11·16	11·51	10·63
	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen ..	4·19	4·39	3·47	4·16	3·84
† Including sand	7·22	7·18	6·63	5·83	5·54

A large number of cakes very rich in oil have been sent to me, some of these being of the kinds called 'Polish,' 'Russian,' or 'St. Petersburg' cake, others of English manufacture.

	No. 1. English.	No. 2. Russian.	No. 3. Polish.	No. 4. English.	No. 5. St. Petersburg.	No. 6. English.	No. 7. St. Petersburg.	No. 8. English
Moisture	11·17	10·12	11·41	11·47	10·58	13·78	11·58	14·18
Oil	14·03	15·07	16·43	13·87	12·77	14·93	14·71	13·13
*Albuminous compounds	26·62	33·53	26·19	30·79	33·54	25·21	30·12	27·31
Mucilage, &c.	34·62	28·20	32·23	28·71	30·34	28·88	30·21	30·58
Woody fibre	7·93	7·40	6·87	8·97	7·73	8·67	8·29	8·96
Mineral matter	5·63	5·68	6·87	6·19	5·04	8·57	5·09	5·84
	100·00	100·00	100·00	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen	4·26	5·36	4·19	4·93	5·36	4·03	4·82	4·37

No. 1 cost 9*l.* per ton; No. 2, 9*l.* 2*s.* 6*d.* per ton, each delivered in June last; No. 4 cost 8*l.* per ton at mills; No. 5, 8*l.* 15*s.* per ton delivered; and No. 6, 8*l.* 10*s.* per ton at mills in November. No. 7, 8*l.* 17*s.* 6*d.* delivered; and No. 8, 8*l.* 15*s.* per ton delivered, both in October.

In one case as high a percentage of oil as 18·03 was found, while several cakes containing over 17 per cent. were analysed.

While it is satisfactory to note this improvement in linseed-cakes, and that the most valuable constituent, the oil, is obtainable in larger amount than threatened to become the case, I am

nevertheless of opinion that, however desirable a cake with such a high percentage of oil may be for the last stages of fattening off stock, or for enabling more material of a somewhat indigestible nature to be mixed with the cake, yet for ordinary feeding purposes a cake with a somewhat smaller quantity of oil, say 11 to 12 per cent., will be found more generally useful and profitable.

Decorticated Cotton-cakes.—While linseed-cake has shown so much improvement, the reverse is the case with decorticated cotton-cake; and if the present deterioration continues, it bids fair to bring this most valuable feeding material into general disfavour. It cannot be denied that at the present time it is a matter of the greatest difficulty to get a decorticated cotton-cake which can be safely given to stock. The excessive hardness, the constant occurrence in the cake of indigestible stone-like lumps, to which I have frequently alluded in my Reports, and the now further lessening of the percentage of oil, through the adoption of more powerful means for its extraction, must cause a general distrust of this kind of cake. It is not here a question of price, for my experience tells me that good and bad qualities sell at the same prices; and it is only a matter of surprise that some of our English makers who import the whole cotton-seed do not set up the necessary machinery for making the decorticated as well as the undecorticated cake. A ready market would be found, I believe, for a much larger sale of this valuable food among many who are now afraid to use it. The only way out of the difficulty has been to grind the hard cake, and many farmers, who have no mill of their own to do the work, have been induced to buy the meal, already ground, at an advance of about 10*s.* a ton above the price of the cake. I have, however, found that the meals so sold are, as a general rule, of very inferior quality, having been made from the very hardest cakes, which there was probably little chance of selling as whole cake. Towards the close of 1884, and until about March, 1885, it was quite possible to get cakes with from 15 to 20 per cent. of oil; but after the latter date in but a very few cases did the samples analysed show 15 per cent. or over, the general average sinking to 12 per cent., and often below this. Were the lessening of the oil the only feature it would not matter so much; but the extreme hardness and lumpiness, consequent on the excessive pressure used, introduce elements of danger in feeding which one cannot too carefully be warned against.

The following are analyses of some cakes and meals showing low percentages of oil:—

	No. 1.	No. 2.	No. 3. Meal.	No. 4.	No. 5.
Moisture	7·68	8·33	8·95	7·28	8·62
Oil	7·70	9·83	9·60	7·83	9·57
*Albuminous compounds	45·94	47·93	45·31	48·31	47·56
Digestible fibre, &c.	27·23	20·68	24·94	23·97	22·50
Woody fibre	4·87	4·60	3·90	5·23	3·13
Mineral matter	6·58	8·63	7·30	7·38	8·62
	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen ..	7·35	7·67	7·25	7·73	7·61

The samples of decorticated cotton-cake, I should say, have been found very pure, though very variable in quality.

Undecorticated Cotton-cakes have not shown any great variations or impurities. In a few cases excessive sand has been found, but the chief objection arises from the fact that frequently a considerable quantity of cotton-seed wool has been left still adhering to the seed, and also that the husk is sometimes far too coarsely ground. Both these causes are productive of harm to stock, the wool and husk frequently collecting together, and producing stoppage and inflammation.

Feeding Meals, Compound Cakes, &c.—A considerable number of these have been analysed. Last year attention was drawn to the variation in the quality of different rice-meals, and this has been again marked :—

	No. 1.	No. 2. Rangoon.	No. 3.	No. 4.	No. 5.
Moisture	10·69	8·30	10·10	9·69	9·23
Oil	8·13	8·83	9·87	14·53	15·26
*Albuminous compounds.. ..	10·44	8·87	11·94	12·33	10·56
Starch, &c.	56·02	42·92	55·24	50·16	50·56
Woody fibre	7·73	18·83	6·10	4·60	4·91
Mineral matter..	6·99	12·25	6·75	8·69	9·48
	100·00	100·00	100·00	100·00	100·00
* Containing nitrogen ..	1·67	1·42	1·91	1·97	1·69

The very high percentage of husk left in No. 2 is specially noticeable. The prices of the above samples differed but slightly. At present, rice-meal is the cheapest source of food of a starchy nature for stock.

The following analysis of palm-nut meal shows the necessity of caution in purchasing it:—

Moisture	8·58
Oil	2·36
*Albuminous compounds	18·87
Digestible fibre, &c.	48·15
Woody fibre	18·00
Mineral matter	4·04
	100·00
* Containing nitrogen	3·02

In this sample almost the whole of the oil originally in the meal has been extracted by chemical means. Good palm-nut meal has about 12 per cent. of oil, which is its most valuable ingredient.

Malted Wheat.—A member of the Society sent me a sample of this, the analysis of which I give side by side with one of malted barley, as lately used in the Woburn experiments:—

	Malted Wheat.	Malted Barley.
Water	9·68	9·35
Oil	1·30	1·97
*Albuminous compounds	10·37	11·37
Starch, sugar, &c.	73·26	68·27
Woody fibre	2·70	5·53
Mineral matter	2·69	3·51
	100·00	100·00
* Containing nitrogen	1·66	1·82

As will be seen, the difference between these is small.

Manures.—The past year has witnessed a considerable fall in the prices of manures generally, but in none has the fall been so marked as in the case of sulphate of ammonia. At the time the last Annual Report was issued, sulphate of ammonia was quoted at about 14*l.* per ton, and nitrate of soda at 10*l.*; but at the present time, while nitrate of soda has advanced to 11*l.* or more per ton, sulphate of ammonia has fallen to just about the same price. This change has arisen from the restricted output of nitrate of soda, and the increasing sources of supply of sulphate of ammonia. That under these circumstances sulphate of ammonia, which in fact contains a larger percentage of nitrogen than nitrate of soda, is considerably the cheaper source of

nitrogen is clear, and of this fact farmers will not be slow to avail themselves. A considerable increase in its use must be expected, it being now cheaper by far than it has ever been before; indeed, at present it is the cheapest form in which nitrogen can be applied to the land. Nevertheless, I believe that there are certain soils on which, and certain conditions under which, nitrate of soda, though dearer, may yet be found the more advantageous to use. It is a point worthy of note, that while the samples of nitrate of soda analysed during the year have shown some variations in quality, the absence of adulteration in the form of salt has been most marked, not a single sample examined having been found to be purposely adulterated.

Refuse Materials.—The following analyses may be of interest:—

	Fur Waste.	Dressed Fur.	Carpet Croppings.		Seal Croppings.		Sealskin Waste.
			No. 1.	**No. 2.**	**No. 1.**	**No. 2.**	
Percentage of nitrogen ..	8·09	8·65	11·32	11·94	11·95	11·67	10·55
Equal to ammonia ..	9·82	10·50	13·74	14·49	14·51	14·17	12·81

	Shrimp Shells.	Fish Liver Refuse.
Water	76·01	26·41
*Organic matter	16·07	24·03
Phosphate of lime	2·09	2·33
Carbonate of lime, alkalies, &c. ..	5·22	10·03
Insoluble siliceous matter	·61	37·20
	100·00	100·00
* Containing nitrogen	1·73	1·71
Equal to ammonia	2·10	2·09

Waters.—A number of samples of water have further been examined. In several of these the amount of solid matters has been found to be enormously large, and when occurring in such quantity, waters are thereby rendered quite unfit for drinking purposes, independently of any further objectionable features they may show. I quote the following analyses (p. 323).

No. 1 was a water from near Marston Morteyne, and was very brackish, owing probably to the existence of saline deposits in the neighbourhood of the well from which the water came.

	No. 1. Grains per Gallon.	No. 2. Grains per Gallon.	No. 3. Grains per Gallon.	No. 4. Grains per Gallon.	No. 5. Grains per Gallon.
Total solid residue (dried at 130° C.)	227·36	159·88	196·00	291·48	1040·2
Oxydisable organic matter ..	·87	·16	·70	1·84	..
Chlorine, equal to chloride of sodium (common salt) ..	117·02	2·31	13·15	7·56	969·51
Nitric acid as nitrates	none	·77	none	none	none
Actual (saline) ammonia ..	·184	·002	·029	·067	·76
Organic (albuminoid) ammonia	·017	·006	·021	·011	·94

No. 2 was a water free from organic or saline impurities, but of so hard a nature, by reason of the carbonate and sulphate of lime it contained, as to be an unsuitable water to use. No. 3 was similarly hard, but was also organically impure. No. 4 came from a well bored through gypsum beds; it contained a very large quantity of gypsum in solution. No. 5 was taken from a marsh at Dagenham, and is overflow water from the Thames below the Crossness sewage outfall. This had an enormous quantity of solid residue, and smelt very strongly of sulphuretted hydrogen gas. The greater part of the solids consisted of common salt. The amounts of ammonia were extremely high. Such a water is perfectly unfit for even cattle to drink. Subsequently I heard that several head of stock, feeding on the marshes where this water overflowed, had died, in consequence, it was believed, of the water, and this I can well understand.

Potale.—His Grace the Duke of Argyll sent me a sample of liquid from a whisky distillery in Argyllshire, which I was informed was used largely for distributing over grass land in the neighbourhood of the distilleries, the liquid being conveyed in pipes and run on to the land, the result being very beneficial to the grass. The liquid was strongly acid, and its specific gravity was 1·016. An analysis of it gave the following results:—

		Grains per Gallon.
Water	96·24	67,368
*Organic matter	3·45	2,411
Mineral matter	·31	221
	100·00	70,000
* Yielding nitrogen	·214	150
Equal to ammonia	·255	179

Considering that the watery liquid has as much as $\frac{1}{4}$ per cent. of ammonia, the fertilizing effect of the quantities of potale poured upon grass land can be readily understood.

List of Analyses made for Members of the Royal Agricultural Society of England from 1st *December*, 1884, *to* 30*th November*, 1885.

Feeding-cakes	508
Compound cakes	18
Feeding-meals	47
Corn, vegetable products, &c.	9
Superphosphates, dissolved bones, and compound manures	417
Guanos	50
Coprolites	5
Bones, bone-meal, &c.	105
Refuse manures	21
Manure-cakes	38
Sewage manures	5
Fish manures	38
Dried blood	1
Horns and hoofs	1
Wool-dust and shoddy	24
Nitrate of soda	65
Kainit and potash salts	13
Sulphate of ammonia	25
Soot	5
Lime, limestone, gypsum, marls, minerals, &c.	10
Soils	27
Waters	79
Milk, cheese, butter, bread	7
Articles of drink	1
Examinations for poison	17
Ensilage	12
Creosote	20
Miscellaneous	19
Total	1587

The experiments at Woburn have been continued, and form the subject of separate papers in the 'Journal.'

J. Augustus Voelcker.

XI.—*Report of the Consulting Botanist for* 1885. By W. Carruthers, F.R.S.

During the past year I have attended to nearly 600 cases submitted to me by members of the Society, mainly referring to the quality of grass seeds for laying down permanent pastures.

It is scarcely possible to realise the great change in the quality of the seeds examined by me during the past year, as compared with the samples submitted only five years ago. This will be evident from a comparison of the results of this year's work with those published in previous Reports.

The samples of meadow fescue (*Festuca pratensis*, Linn.) have been almost free from rye-grass. In 1883 I found 71 per cent. of the samples adulterated with rye-grass, and in 12 per cent. of these it amounted to more than half the seeds. In 1884 rye-grass was found in 34 per cent. of the samples. During the past year I have met with it in only 5 per cent. of the samples. The gain is, of course, not limited to the members of the Society whose samples I have examined, nor even to the members of the Society at large, but farmers everywhere have benefited from this remarkable improvement. If the advantage represented only the saving effected by securing a pure high-priced seed at the same rate as was formerly paid for adulterated seed it would be very considerable; but it is much greater when we look at the results, and contrast the perennial grass of the highest quality produced in the meadow by every seed of last year's samples with the short-lived inferior grass produced in greater or less quantity by nearly three-fourths of the samples of only two years ago. The germination of the meadow fescue is also greatly improved; only 5 per cent. germinated less than 90 seeds in the 100, while in 8 per cent. every seed germinated.

The samples of tall fescue (*Festuca elatior*, Linn.) have been, on the whole, more true to the species. In 1883 I included this grass with the meadow fescue, because, "with the exception of three or four cases, all the samples sold as tall fescue were really meadow fescue." In 1884 meadow fescue was present in 30 per cent. of the samples; this year the proportion has fallen to 18 per cent. Figures cannot so easily represent the improvement in relation to rye-grass. Last year 50 per cent. of the samples contained rye-grass; this year it was found in 46 per cent., but in only one case did it reach nearly a third of the whole, while in the majority of cases the quantity was so small that it was probably accidentally present, and not introduced for the purpose of adulteration. The seeds of this grass are

seldom in such good condition as those of the meadow fescue, but there has been in the samples of the year a decided improvement. Only 6 per cent. have germinated under 60 in the 100, and no less than 64 per cent. have germinated more than 80 in the 100. In two cases ergot was present in the samples.

The smaller fescues (sheep's fescue, hard fescue, and red fescue) have been very irregular in their germination. The true sheep's fescue (a small smooth seed) has in no case germinated more than half the seeds, while the hard fescues have been more frequently from 80 to 90 per cent. *Molinia cærulea*, Moench., a worthless grass found in wet moors, has been used as an adulterant in hard fescue.

The samples of cocksfoot (*Dactylis glomerata*, Linn.) were, on the whole, pure. In 18 per cent. there was an appreciable quantity of the seeds of other grasses present, but in no case did they amount to 20 per cent. Only 8 per cent. of the samples germinated less than the half of the seeds, and 75 per cent. germinated more than 80 seeds to the 100.

The great improvement in the quality of the seeds is as obvious in foxtail (*Alopecurus pratensis*, Linn.) as in any other grass. Only four years ago, in fixing a minimum standard to guide the members in purchasing seeds, the Council recommended that the germination of foxtail should be not less than 20 per cent.; owing to the improvement in the seeds the percentage was raised two years ago to 50, and this year, as only 3 per cent. germinated less than half the seeds, there is no reason why it might not be again considerably raised. As this is so important a grass, and its great defect hitherto has been the lowness of its germination, it is very gratifying to find that the samples this year had such a high percentage. Twenty per cent. germinated between 50 and 60 in the 100; 27 per cent. between 60 and 70; 44 per cent. between 70 and 80; and 6 per cent. germinated more than 80 in the 100. The chief cause of the lowness of germination in this grass has been the harvesting of the seed before it was ripe. But, besides this, the seed is subject to the attack of thrips. The eggs of the insect are hatched in the flower, and the insect itself passes through its various stages within the glumes, living on the seed. In seeds of the previous harvest the insect is generally found in the grub condition, a small, broadly oval, segmented worm, of a pale-yellow colour. The adult insect, which has a shining black body and long fringed wings, is not infrequent, but I have never found it alive. In all the samples examined by me this year I have found the thrips,—from 2 to 22 per cent. of the seeds having been destroyed by them.

Some of the samples of fiorin are largely composed of chaff,

but the dangerous impurity to be avoided in this seed is ergot. In more than half the samples I have examined during the year, ergot was present. I am thoroughly satisfied that it is much better to omit fiorin in laying down pastures than to use seeds containing ergot, which would certainly introduce this dangerous parasite. Abortion in stock is no doubt due to several causes, but it is certain that amongst them must be reckoned the presence of ergot in their food. The ergot is not so likely to be injurious in pastures, for, as a rule, stock reject the seeded heads of grasses; and besides, when the meadows are fairly pastured, the grasses that are the favourite food of the stock are not permitted to go to flower, and the ergot does not appear, as it can be developed only after the flowering of the grasses. The ergots are of different sizes in the different grasses, but the ergot of any grass will produce the disease in any other grass in the meadow, where it grows on the ground in the following year.

During the year I have had brought under my notice several instances of abortion, but the only case in which it seemed to me clear that the abortion was due to ergot was that of several cows near Kilkenny. I obtained specimens from the hay on which the cows were being fed, and I found that both the cocksfoot and tall fescue were very badly ergotted, some heads having eight or ten ergots. The hay had been grown on a damp imperfectly drained soil; this, together with the generally moist atmosphere of the south-west of Ireland, would account for the prevalence of ergot in the pasture. If the sample sent in the least represents what may be found in the meadow-hay of that district, and from facts already in my possession I fear it is so, then all haying should be stopped (I am afraid it cannot be authoritatively forbidden) for several years, and the pasture closely fed off. In this way the ergot might be destroyed, for without the flowers of the grass the spores would not produce the fungus, as they can grow only on grass flowers.

Three samples have been submitted to me, which were offered as "*Festuca loliacea*," but which entirely consisted of the seeds of manna or flote grass (*Glyceria fluitans*, R. Br.). The name *Festuca loliacea* appears in some trade lists. But the plant intended is a hybrid between meadow fescue and rye-grass which occasionally is met with, but nowhere has been able to keep its place as a permanent variety. Sinclair gives a very good figure of it, and apparently secured a considerable quantity for analysis. He observed that, like other hybrids, it does not perfect its seed, the flowers being generally abortive. Its cultivation is consequently, as he says, inconvenient and expensive. Its increase by dividing the roots and transplanting

would not repay, as the variety has no special merits. The manna grass has a head somewhat like that of the hybrid, and is offered in its place. But it is unsuited for pasture, as it is not eaten by stock, and grows naturally only in ditches, stagnant waters, or wet boggy land.

The samples of Timothy (*Phleum pratense*, Linn.), have been, as they usually are, free from impurities, and their germination has been high, only 4 per cent. growing less than half the seeds, the great majority germinating from 97 to 100 per cent.

The same may be said of the crested dogstail (*Cynosurus cristatus*, Linn.), where the only impurity has been the presence of shelled seeds of Yorkshire fog in one of the samples.

Of the meadow grasses, the purest and best in germination is the rough-stalked meadow-grass (*Poa trivialis*, Linn.), which is also the most valuable in the pasture. Frequently this seed is imperfectly cleaned from the chaff; in 8 per cent. of the samples examined no less than one-third of the bulk was composed of this useless chaff. The seeds of *Glyceria distans*, Wahl., a worthless grass found on our sandy shores, was employed to adulterate a few samples, though in no case reaching more than 22 per cent. The germination was satisfactory—20 per cent. germinated less than 80 in the hundred, 24 per cent. between 80 and 90, and 56 per cent. over 90 in the hundred. The smooth-stalked meadow-grass (*Poa pratensis*, Linn.) was also adulterated, and to a greater extent, with *Glyceria distans*, Wahl., and its germination was low, in no case reaching 50 per cent. The wood meadow-grass (*Poa nemoralis*, Linn.), had a higher germination, but not equal to that of *Poa trivialis*, Linn., and it was also to some extent adulterated with the *Glyceria*.

The samples of vernal grass (*Anthoxanthum odoratum*, Linn.), were all free from the seeds of the worthless annual vernal grass, which is not unfrequently met with as an adulterant of this grass. The germination is on the whole low, the highest giving only 75 per cent., and the others ranging downwards to 29 per cent.

The samples of yellow-oat grass (*Arrhenatherum avenaceum*, Beauv.) have all been very impure, and with a low germination. One sample had no more than 30 per cent. of the grass, and the best had only 74 per cent. In one sample the germination was only 5 per cent., and the best was 45 per cent.

The clovers do not present any points of special interest. Their germination has been satisfactory, and, except that dodder was found in 12 per cent. of the samples, they were free from weeds.

The great progress made in supplying good and pure seeds extends, I believe, to the larger houses throughout the country, but, from some experience, I fear that the smaller dealers in market towns distribute large quantities of worthless materials among farmers. This will be best illustrated by an example:—A member of the Society in Kent bought from a merchant in a neighbouring market town six different grasses, in various proportions, to lay down some land. The purity and germination were guaranteed. In the course of the season the bulk of the crop was found to be rye-grass, though no rye-grass seed had been included in the order. The samples were then sent to me. I found that what had been sold as meadow fescue was composed of 76 per cent. rye-grass, 16 per cent. meadow fescue, 4 per cent. Yorkshire fog, and 1 per cent. each of meadow grass, cocksfoot, golden-oat grass, and black grass. The tall fescue sample consisted of 67 per cent. of fescue, all, except a seed or two, being meadow fescue, 19 per cent. rye-grass, 7 per cent. Yorkshire fog, 6 per cent. cocksfoot, and 1 per cent. black grass. The sample of cocksfoot contained 7 per cent. of Yorkshire fog and 3 per cent. of rye-grass; and the fiorin was mixed with timothy, and had numerous ergots. The condition of the field was what might have been expected from such seeds. Compensation was claimed and obtained from the merchant. In his justification he stated that he had sold the seeds just as he had bought them, and that no complaints had reached him from any other quarter. It is very difficult to influence merchants who are not acquainted with the goods which they sell, but who simply pass them ignorantly through their hands. No doubt the publication of a few cases like that which I have stated would have a beneficial effect, but so long as farmers seek only a low-priced article, and accept and sow worthless seeds without complaint, such will be supplied by the merchant, for they certainly bring a profit to him.

The samples of mixtures for laying down permanent pastures still show that this is a very undesirable way to purchase seeds. Many worthless grasses, worse than weeds, are thus introduced into pastures. The table on page 330 shows the composition of eight mixtures which I have recently analysed. In only two of these can the selection of the grasses be regarded as at all satisfactory.

A worse mixture was sent by a member who had taken it from the bulk of what an out-going tenant-farmer was sowing on the land, perhaps in ignorance of its true nature, but with the prospect of securing compensation for laying down the field.

ANALYSES OF GRASS MIXTURES.

	No. 1237.	No. 1253.	No. 1284.	No. 1285.	No. 1349.	No. 1556.	No. 1571.	No. 1572.
Meadow grasses ..	40	9	37	26	20	28	..	22
Cocksfoot	9	..	18	13	14	30	29	33
Foxtail	7	2	2	8	22	11	..	9
Dogstail	6	1	..	..	..	4	..	4
Meadow fescue ..	6	28	8	7	13	8	20	14
Small fescues	3	11	9	15	14	18	9	9
Fiorin	..	..	..	12	..	..	..	..
Timothy	..	..	..	..	5	..	..	..
Oat grass	..	..	..	..	4	..	..	..
Tall fescue	..	..	..	..	½	..	..	..
Clovers	..	..	..	..	3	..	..	..
Sweet vernal	..	..	..	..	..	..	..	9
Rye-grass	26	45	19	16	4	..	34	..
Yorkshire fog	1	3	..	1	½	1	1	..
Brome grass	1	1	..	..	..	..	..	..
Slender foxtail	1	..	..	..	..	..	..	..
Glyceria distans ..	..	..	7	..	..	..	..	..
Aira cæspitosa ..	..	..	..	2	..	..	..	..
Italian rye-grass ..	..	..	..	..	..	..	7	..

Three-fourths of the bulk consisted of vegetable *débris*, chiefly of the flowers and empty pods of clover. The seeds consisted of:—

52 per cent. rye-grass.
18 ,, Yorkshire fog
14 ,, trefoil
5 ,, red clover
3 ,, fiorin
2 ,, dogstail
2 per cent. meadow fescue
1 ,, cocksfoot
1 ,, meadow grasses
1 ,, buttercup
1 ,, ribgrass.

That even worse material is disposed of to growers was shown to me by the examination of a "sample of permanent pasture grass" offered by a firm of seed merchants in a market town in Lincolnshire to merchants in London, who, on seeing the character of the mixture, were good enough to send it to me for my information. This mixture is no doubt now forming a pasture somewhere in England, more permanent than the grower, perhaps, wishes. It was composed of the following seeds:—

46 per cent. Yorkshire fog
21 ,, dogstail
11 ,, rye-grass
5 ,, cocksfoot
4 ,, foxtail
3 per cent. yellow-oat grass
3 ,, buttercup
3 ,, meadow grasses
2 ,, flote grass
2 ,, fiorin

The most important assistance that the Council have obtained in their efforts to improve the quality of seeds supplied to growers has been the step taken by H.M. Office of Works, in inviting tenders for the supply of grass seeds of a guaranteed purity and quality. At the request of the Department, I prepared a list of seeds suitable to this purpose, and specified for each a percentage of germination which could easily be obtained. The tender was to be framed on these minimum rates; but to encourage merchants to offer the best seeds, payment is to be made *pro rata* for every completed 5 per cent. beyond the specified amount. The seeds are to be delivered in bulk, and the report of the Consulting Botanist of either this Society, the Highland and Agricultural Society, or the Royal Dublin Society is to be final.

The terms proposed and adopted were the following:

1. The seeds must be true to the species ordered.

2. There must not be more than 5 per cent. of seeds of other species than that ordered.

3. The grass seeds must be free from ergot.

4. The clover seeds must be free from dodder and broom rape.

5. The seeds must germinate not less than 90 per cent. for *Dactylis glomerata*, *Festuca pratensis*, *Phleum pratense*, *Cynosurus cristatus*, and the clovers; 75 per cent. for *Festuca elatior*, *Poa trivialis*, *Poa pratensis*, *Agrostis stolonifera*, and *Festuca duriuscula;* and 60 per cent. for *Alopecurus pratensis*, *Anthoxanthum odoratum*, and *Avena flavescens.*

6. The higher value of a seed evidenced by a superior germination will be paid for, *pro rata* for each completed 5 per cent. beyond the amounts specified.

7. The reports on the conditions specified of the Consulting Botanist either of the Royal Agricultural Society of England, the Highland and Agricultural Society of Scotland, or the Royal Dublin Society will be final.

Several cases of oats destroyed by vibrios have been brought under my notice. The injury seems to have been somewhat frequent this year in different parts of England. It appears in the early summer. The oats having made some progress, and attained a height of from four to six inches, have their growth arrested, and the plants when closely examined are found to have a number of curled-up, twisted, and knotted shoots, at the base of the stem under the ground, or just above the surface. The injured plants occur in patches over the field, though sometimes the whole field is equally affected. When an injured plant is carefully examined, it is found that the first or main stem is dead. This has been caused by the attack of micro-

scopic worms, closely resembling in size and appearance the worms that cause the disease of purples in wheat, and which I have figured and described at length in the Society's 'Journal' (vol. xviii., New Series). These minute nematoid worms having destroyed the main axis, the plant in its effort to maintain its life has thrown out new shoots from the axils of the leaves below the injured portion. These shoots being in their turn attacked and destroyed, further efforts are made to produce other shoots lower down the stem. The original leaves of the main stem being yet vigorous and closely surrounding the stem, the young shoots have difficulty in pushing their way through; and further, weakened by the attacks of the worms, they are arrested in their growth, and appear as crumpled and swollen buds around the base of the plants. A similar injury to a plant of wheat is figured and described in the paper to which I have referred. But it is probable that the species of worms are different, and that the vibrio causing the injury to oats would not attack wheat, for Mr. Orlebar, of Podington, Wellingborough, informs me that in 1884 he had a field of oats so injured by vibrio that he ploughed it up and fallowed it; and this year, at the time when the oats in a neighbouring field were being destroyed by the vibrio, that field was producing a fine crop of wheat. This treatment of the diseased oats would not have destroyed the worms, and, though they were no doubt present in the soil, the wheat was not attacked by them. They attack equally all kinds of oats. Neither the quality of the soil nor the previous cropping or manuring seems to have any relation to the presence of the worms. And the disease, where it does occur, may be inexplicably limited. Mr. Orlebar says that in his case, "the diseased plot is about six acres in extent; a small part of the same field, about half an acre—a long narrow strip,—is separated by a roadway about five yards wide, but without any fence, from the diseased portion. On this narrow strip no disease is visible, and the oats are many inches higher. The narrow strip was last year (1884) sown with thousand-headed kale (a poorish crop) instead of turnips, and the sheep were on this for only about two days, so the strip should be poorer than the large piece." The disease is called by the labourers at Wellingborough "bizzened oats," a corruption, Mr. Orlebar thinks, of burst or ruptured, for it is the same term as the labourers apply to pigs when ruptured, and to onions affected with a disease like that of the oats. In Yorkshire the local name, as Mr. Scarth, of Stanghow, Skelton, informs me, is "seging."

It is impossible to do anything to cure the injured plants, as the minute worms are in the interior of the stem, and nothing

could destroy them that did not at the same time destroy the plants. But if, as I suppose is the case, the worms limit themselves to oats, then it is obviously desirable to avoid, for some years, growing oats in a field where the presence of the vibrios has been detected.

XII.—*Report on the Cheesemaking Competition at Preston.* By Mrs. L. NUTTALL and Mrs. E. GIBBONS.

THE Judges were greatly disappointed at finding so limited a competition in this class, and much regret that the makers of the district in which the Show was held, and also those of other varieties of English cheese, did not avail themselves of the opportunity thus afforded them of competing for the very valuable certificates offered by the Royal Agricultural Society of England, and further of embracing so convenient a time for giving and receiving instruction in this highly important branch of dairy husbandry. They are of opinion that through this competition much good might and will be done when its advantages are duly appreciated, and that it will prove a powerful instrument for spreading high-class dairy education.

The two competitors were—

> No. 1.—Mr. F. IRVINS, of 62, Storie Street, Paisley; and
> No. 2.—Mr. J. STEVENSON, of Springfield, Dunlop.

No. 1, who had been engaged as a cheesemaker in Canada, gave us his process as follows, viz.:—That the milk as soon as taken from the cow should have its temperature reduced below 60°, but on its being vatted for cheese-making the heat should be raised by steam to 92°, and then allowed to cool to 88°, being in motion all the time. Then 4½ oz. of rennet put to 1000 lbs. of milk, which, by the above process, is supposed to be ripened or rendered slightly acid, but he objects to any acid being mixed with the milk. The curd should be quite sweet, but by exposure to the atmosphere allowed to acidify before salting, and thus he would be enabled to produce a cheese fit to eat in three months, but which would be better at nine. The whey to be set and skimmed for butter. No. 2, who had had experience of cheesemaking in the United States of America, described his process in the milk stages much in the same terms as No. 1, but he adds the rennet at 82°, and after breaking the curd down, raises the heat to 100°, and stated that his cheeses were fit for consumption in three months, and would keep good for two or three years. The whey was not to yield any cream. On July 10th, No. 1

received 1050 lbs. of new milk at 60° heat, which in one hour and a quarter he raised to 88°, used 1 oz. of colouring, added 4 oz. of rennet, stirring quickly for the first five minutes, then slowly for fifteen minutes, when another ounce of rennet was added, the mass being ready to cut down in sixty minutes; it was at once cut into square pieces, and in about fifteen minutes steam was turned into the case, gradually raising the heat to 100°, being kept stirred with the hands the whole time; the whey was then let off, the curd laid out to cool and acidify, and when considered sufficiently so, ground coarsely by an American mill; $2\frac{1}{4}$ lbs. of salt was mixed with the 104 lbs. of curd, which was then put into a vat, placed in press, remaining there until the next morning, when it was taken out and bandaged ready for the cheese-room.

No. 2 the same day received 950 lbs. of milk at 60°, to which, after raising it to 84°, he added and well stirred in $2\frac{1}{2}$ oz. of colouring, then $3\frac{3}{4}$ oz. of rennet, stirring the mass quickly for five minutes, and slowly for twenty-seven ditto, when it had much thickened. At fifty-five minutes after applying the rennet he cut the curd up small, and then stirred with rakes for an hour and a quarter, during which time the heat was gradually raised to 98°. The curd was then allowed to settle for thirty minutes, when the whey was syphoned off and the curd turned about until dry, when it was passed through a machine called a curd-mill. The curd was put on to a set of knives, on which descended a press, forcing it through what was very like an ancient turnip-cutter. Much inconvenience occurred and time was lost through clinging of the curd, and the machine did not answer well. $2\frac{1}{4}$ lbs. of salt was mixed with the 94 lbs. of curd, which was put into the vat and under a press at 8.45 P.M. The vessels and things were washed and left ready for next morning, and the day's work was finished by nine o'clock.

On July 11th, No. 1 received 1200 lbs. of milk at 10.40, showing 8 per cent. of cream. He began by applying a small steam heat in the vat casing, raising the temperature to 94° in one hour and a quarter, and reducing the same to 88° in two hours; the milk was kept constantly in motion during this so-called ripening process, and a sample taken at this stage yielded 9 per cent. of cream, but it kept sweet longer than the one taken at 10.40. At 12.40, $5\frac{1}{2}$ oz. of "Hansen's Rennet" was added at 90°, and the mass stirred well for four minutes; it thickened in eleven minutes, and broke well over the finger in twenty-two minutes quite clear; at 1.20, or forty minutes after the rennet was added, it was cut up with American curd knives, both ways, stirred for fifteen minutes, and steam turned on, raising the temperature to 102° in thirty-five minutes, during

the whole of which time it was kept in motion with the hands; ran whey off at 4 o'clock at 98°. The curd at this stage was in pieces about the size of a hazel-nut, and not allowed to solidify. It was then placed on a drainer lined with muslin, and covered with a thick cloth and brown-paper sheets, the curd being frequently moved to prevent its becoming solid, and steam applied to keep the heat stationary until it was considered sufficiently acid, which was tested by taste, also by putting a piece of the curd against a hot iron until it would draw into strings at least two inches in length; $2\frac{3}{4}$ lbs. of salt was mixed with the 121 lbs. of curd, which, still as large as nuts, was unground, put into two vats and pressed at 7.30, with a pressure of 15 cwts.; dry cloths were applied, and the cheese taken out at 11.30 on the 13th. Whey showed 1 per cent. cream. No. 2 also on the 11th received 850 lbs. of milk at 10.40, showing 8 per cent. of cream; steam was admitted into the case, gradually raising the heat in one hour and a quarter to 86°, which constant stirring reduced to 82°. To test the ripeness of the milk at this stage, he took 4 oz. of it, adding 1 drachm of rennet to show the thickening in twenty-eight to thirty-two seconds, this became solid curd in sixty seconds, and a milk sample also then taken yielded 9 per cent. of cream. At 12.45, $3\frac{1}{2}$ oz. of rennet, mixed with $3\frac{1}{2}$ oz. of water, was stirred into the milk, which was continually agitated until after it had thickened; after standing sixty minutes the curd was cut with knives into small pieces, steam turned on, and quickly moved with rakes for one hour and a quarter, when the temperature had slowly risen to 98°; it was then allowed to settle, and the whey syphoned off at 4.25. The curd, kept in pieces the size of peas, was drained and dried on cloths till 7.45 P.M., when it weighed $84\frac{1}{2}$ lbs.; 2 lbs. of salt having been mixed in, it was put into a vat, and under pressure of 15 cwt.; at 8 o'clock the cloths were changed and washed in pearlash, and pressure increased to 25 cwt., under which it remained until the Tuesday following, when distinctive marks having been placed on each cheese, they were sent off for the purpose of being thoroughly cared for and ripened in the cheeseroom of one of the Judges. In December (when five months old), they were tested, with the following results:—

No. 1.—First day's make.	Poor, uncured, full of holes, bad flavour; weighed 89 lbs.
„ Second „	Fairly good, being clean, of good texture, perfect cure; weighed 103 lbs.
No. 2.—First day's make.	Highly coloured, dry and poor; quality inferior; weighed 74 lbs.
„ Second „	Good texture, poor quality, and the flavour imperfect; weighed 71 lbs.

Whilst admitting that cheesemaking under the varied temperature and such other circumstances as a competition in a Showyard are somewhat against the manipulation, but not seriously to interfere with the results, the Judges are of opinion that both competitors displayed some considerable knowledge of cheesemaking; but the processes, as exemplified by them, were such as to be totally unfitted for a farmhouse dairy, and of such a tedious nature that no time would be at the disposal of the housewife for her other important duties. Therefore, under the circumstances, the Judges do not feel justified in recommending the Society to award to either of them a certificate of first-class merit; and the Judges are further of opinion that these methods of cheese-making are not calculated to raise the standard of English cheese, a result which the Royal Agricultural Society of England doubtless has in view.

XIII.—*Quarterly Reports of the Chemical Committee.*

March, 1885.

1. Mr. John Maddison, of Foxberry, Aldbro', Darlington, sent, on January 6th, two samples of cake, one linseed, one cotton. The analyses and report were as follows:—

	Linseed-cake.	Cotton-cake.
Moisture	10·48	13·95
Oil	9·07	6·57
*Albuminous compounds	24·01	26·06
Mucilage, &c.	35·24	30·06
Woody fibre	10·57	17·53
†Mineral matter	10·63	5·83
	100·00	100·00
* Containing nitrogen	3·84	4·17
† Including sand	5·54	..

Linseed and Cotton-cakes.

"J. Maddison, Esq. January 9th, 1885.

"Dear Sir,—I enclose the analyses of these two cakes. The cotton-cake is good both in quality and condition. The linseed-cake is, however, an impure and an inferior one. Kindly say whether the latter was sold to you as pure, and fill in replies to the following questions relating to the linseed-cake.—Yours faithfully, J. Augustus Voelcker."

From the replies received it appears that six tons of the linseed-cake had been bought from Messrs. J. Hindhaugh and Co., 38, Cloth Market, Newcastle-upon-Tyne, the cake being invoiced as pure cake at 8*l.* 7*s.* 6*d.* per ton at Hull, and branded 'J. E. & S. pure.' Mr. Maddison added that though not in want of cake at the time he had been tempted by the low price

for pure cake not to let the opportunity slip. A whole cake sent proved to be as bad as the original sample. Further letters were received from Mr. Maddison on February 10th and February 19th:—

"Foxberry, Albro', Darlington, February 10th, 1885.

"To J. A. Voelcker, Esq.

"DEAR SIR,—I am still in communication with Messrs. J. Hindhaugh and Co., respecting the linseed-cake; they refuse to give me the name of the maker, saying he is not the responsible party. I had a letter from them asking me to name a reasonable sum that I would take for the cake being deficient; I offered to take two tons of good cotton-cake. In reply to it they say the maker requests me to send the whole of the cake on hand back, so that they may have it fairly examined. I have written to them to-day declining to send all the cake back, as I had already sent them two whole cakes to show them, and if I could not get the little I had asked for I would have to try what the law would do for me in the matter.—I am, Sir, yours truly, J. MADDISON."

"Foxberry, Albro', Darlington, February 19th, 1885.

"To J. A. Voelcker, Esq.

"DEAR SIR,—I had a letter yesterday from Messrs. J. Hindhaugh and Co. to say they had a letter from John Ellershaw and Sons, the makers of the cake I complained of, and they say they have had the cake I sent to them analysed by you, and that it has been returned as pure, and that the depreciation arises through the cake being kept too long. Is that so?—Yours truly,

"J. MADDISON."

Dr. Voelcker replied on February 20th that the keeping of the cake for a long time would not put into it any impurities which did not originally exist in it.

2. Mr. Joseph Martin, of Highfield House, Littleport, Ely, sent, on February 7th, a sample of cotton-cake and one of linseed-cake. Dr. Voelcker reported as follows:—

COTTON AND LINSEED-CAKES.

"Joseph Martin, Esq. February 11th, 1885.

"DEAR SIR,—The cotton-cake is pure and of fair quality. The linseed-cake is one of the hardest pressed I have seen, and, besides being so extremely poor in oil, is also low in albuminous compounds, and contains a large quantity of starchy impurities.—Yours faithfully,

"J. AUGUSTUS VOELCKER."

Analyses.

	Cotton-cake.	Linseed-cake. Branded pure.
Moisture	15·72	14·01
Oil	5·13	6·07
*Albuminous compounds	21·34	24·66
Mucilage, &c.	31·03	40·62
Woody fibre	21·83	8·17
Mineral matter	4·95	6·47
	100·00	100·00
* Containing nitrogen	3·41	3·95

"J. AUGUSTUS VOELCKER."

Mr. Martin in reply sent contract and invoice, from which it was found that 10 tons of pure linseed-cake had been contracted for at 9*l.* per ton, a portion of which has been already received. The vendors were the manufacturers, Messrs. Henry Leake and Son, of King's Lynn.

In correspondence with Mr. Martin, Messrs. Leake and Son sent the following memorandum:—

"Memo. from Henry Leake and Son, Oil Cake Mills, King's Lynn,
"February 13th, 1885.

"Joseph Martin, Esq., Littleport.

"Dear Sir,—We beg to return enclosed, and thank you for letting us see it. We don't see name of analyst, but from the wording we should judge it is not from Voelcker's office.

"It is a curious thing as bearing upon the value of these analyses that we work at the lowest pressure on the cake of almost any mills in the country, and yet they return it as 'one of the hardest-pressed seen.' The fact being that there is the greatest difference in the constitution, and therefore in the working, of one sort of seed from the other; of this the analysts seem quite ignorant, and they visit on our unlucky heads every divergence from a standard of their own; and this is a remarkable instance of it.

"Our general habit is to work North Russian seed, which yield a softer, darker, more albuminous cake; but last year the North Russian seed crop was a failure, and it is not to be got now, therefore we have to fall back upon the Indian seeds, which are poorer in albumen, and make a very light coloured cake, which it is usual to darken with Black Sea Rape-cake. You will find all English cake not so darkened, lighter in colour than usual this year, and you can generally detect the rape by the taste.

"Now as bearing out what we say as to the unreliability of these analyses, we hand you copy of one made by Mr. Knight, Cambridge (who we rather think is the one who made your report). Now this cake was sent him in 1881, and he reports it 'a genuine sample of linseed-cake, of about fair average quality.'

"Now if you will compare the figures yours is the best of the two. The albumen is practically the same in both; why then did he not report the other as short in that respect? Mucilage, just as important and useful, is very much higher in yours, whilst the more useless parts, woody fibre and mineral matter, are much lower! As for oil, our business is to extract the oil, which is medicinal but not feeding; it would be well for us if we could reduce it to 6 per cent., as he says; but there must have been something special about the piece of cake you sent (for they do vary), if it really only showed such a small proportion of oil; we cannot work it down to that, nor anything like it on the average.

"As to the starchy impurities, we can only account for such a report by the white colour of the cake when ground, arising, as we pointed out before, from the sort of seed used without rape.

"We have some of our summer-made cakes from Archangel seed in stock; if you like to try them we are sure you will like them, but really we are using the other cake ourselves, and we find it a most useful cake; the stores do remarkably well on it, and we are surprised how it put on the fat when more was used, and we are sure that you will find no fault with the results, which, after all, are worth more than all the analysts' reports in the world.

"1881.—Copy of analysis of linseed-cake made by Henry Leake and Son, by Mr. Knight, Cambridge:—

Moisture	12·82
Oil	7·95
*Albuminous	24·81
Mucilage	34·26
Woody fibre	11·76
Mineral	8·40
	100·00
* Containing nitrogen	3·95

"'I consider it a genuine sample of linseed-cake, of about fair average quality.'"

3. Major Forster, of Exbury House, Exbury, Southampton, sent, on February 10th, a sample of linseed-cake, upon which Dr. Voelcker reported:—

"February 16th, 1885.

"LINSEED CAKE, No. 207.

Moisture	14·88
Oil	10·26
*Albuminous compounds	21·62
Mucilage, &c.	33·58
Woody fibre	13·74
Mineral matter	5·92
	100·00
* Containing nitrogen	3·46

"J. AUGUSTUS VOELCKER.

"DEAR SIR,—The linseed-cake is an impure cake, containing a very large quantity of foreign seeds; it is very low in albuminous compounds, and correspondingly high in woody fibre.—Yours faithfully,

"Major Forster. J. AUGUSTUS VOELCKER."

The cake had been purchased at 9*l.* per ton from the manufacturers, it being described as home-made oil-cake.

The following correspondence passed:—

"Exbury House, Exbury, Southampton, February 22nd, 1885.

"Dr. Voelcker.

"LINSEED-CAKE, No. 207.

"DEAR SIR,—I sent my bailiff on Friday to interview the manufacturers, and they have sent me the enclosed, which perhaps you will kindly return after perusal, and noting any points in it you may consider essential.

"You see how, for the sake of 1*l.* per ton saved in money, all good in the shape of food is sacrificed by that most benighted of beings, the British farmer.

"I am unfortunately late in life and a great invalid, farming very largely, and of course have to trust to my employés, and it was only by accident I looked in at 1 P.M., when the cake and meal was being served out, that my eye caught sight of the cake sent for your analysis.

"I have three bailiffs, and they invariably replied to my queries as to the cake used that 'it was very good.' I gave orders that pure linseed, crushed

in the mill with bruised wheat, should be used, and no linseed-cake, but alas! it is easy to order, but how difficult to get obedience!—Believe me, yours faithfully, J. FORSTER."

The following is the letter from the manufacturers:—

"Major Forster. February 20th, 1885.

"SIR,—Your bailiff, Mr. Kidd, called here this afternoon relative to the quality of the D linseed-cake supplied to you lately. He informed us that you had had a sample of it analysed, and it was reported on unfavourably, as to its purity, &c. We would point out to you that we did not represent it as being a perfectly pure cake, but knowing you had used some quantity of this mark of cake, we quoted a price for it on January 3rd last.

"It is a cake of which we sell a larger proportion of than of any other mark, and as it is largely used by nearly all our customers, that is a sufficient proof of its feeding qualities. We have furnished Mr. Kidd with a sample of cake (mark D.G.). This we guarantee to be made from 95 per cent. East Indian linseed, the best that is imported.

"If you will kindly have this sample analysed and approve of its quality we will supply the remainder of the quantity, as quoted on the 3rd January, of this description of cake at the price of 10*l.* per ton, which is the relative difference in price (1*l.* per ton) between this mark and the D mark of cake.

"We would at all times prefer to sell by sample, and will guarantee anything then sold to be equal to the sample it is sold by."

This case shows the false economy of buying any thing of less than guaranteed purity.

4. Mr. R. Fearnall, of Lea Hall, Aldford, Chester, sent, on February 17th, a sample of boiled bones bought at 6*l.* per ton for opinion as to purity. On Dr. Voelcker replying that they were not pure, and advising Mr. Fearnall to have them analysed, this was done. The analysis and report were:—

Water	17·01
*Organic matter	18·79
Phosphate of lime	45·84
Lime, sulphuric acid, chlorine, &c.	16·54
Insoluble siliceous matter	1·79
	100·00
* Containing nitrogen	1·08
Equal to ammonia	1·31

"DEAR SIR,—This is not a pure sample of boiled bones, but one which appears to have been treated with sulphuric acid, which, along with common salt, it contains in considerable quantity. A good sample of boiled bones should contain more phosphate of lime than this sample, which is, exclusive of carriage, not worth more than 4*l.* 15*s.* per ton, or 5*l.* at the most.—Yours faithfully,

"R. Fearnell, Esq. J. AUGUSTUS VOELCKER."

Two tons had been purchased through Mr. Rowe Morris of Mr. Abraham Lloyd, of Standish Lower Ground, Wigan, Lancashire.

5. Mr. William Frankish, of Limber, Ulceby, vice-chairman of the Farmers' Co., Ld., Brigg, sent on January 21st, a sample of linseed-cake for analysis, of which 50 tons had been supplied to him by the company named, adding that he sent it as a neighbour had received a very bad report upon a similar cake sold to him by the Company.*

Dr. Voelcker's report and analysis were :—

"January 31st, 1885.

"DEAR SIR,—The linseed-cake is a dirty impure one, of very low quality. —Yours faithfully, J. AUGUSTUS VOELCKER."

Moisture	9·32
Oil	8·63
*Albuminous compounds	21·06
Mucilage, &c.	39·33
Woody fibre	11·14
† Mineral matter	10·52
	100·00
* Containing nitrogen	3·37
† Including sand	5·43

6. Mr. John Turner, of the Grange, Ulceby, on February 2nd, sent a linseed-cake for analysis.

The report and analysis were :—

"J. Turner, Esq. February 7th, 1885.

"LINSEED-CAKE, 168.

"DEAR SIR,—This is a very inferior and adulterated cake. It is extremely low both in oil and albuminous compounds, and contains a large quantity of sand, besides foreign seeds.—Yours faithfully,

"J. AUGUSTUS VOELCKER."

* With reference to this case, the following letter of explanation from the Managing Director of the Company was received :—

"Yarborough Oil Mills, Brigg, May 4th, 1885.

"DEAR SIR,—Would you do me the favour to bring before the Chemical Committee on Tuesday next my explanation as to the mistake made in the linseed-cake analysed for Mr. Frankish in January last by Dr. Voelcker, and published in the agricultural papers.

"In October last a parcel of Baltic linseed (about 350 qrs.) came to hand inferior to sample, and was put on one side until it could be screened and cleaned. Early in January we were crushing Baltic seed, and when the parcel was nearly finished, I gave orders to follow on with a similar lot; but, by some unfortunate misunderstanding, about 200 qrs. of the unsound seed were used, the result being the production of from 40 to 50 tons of inferior cakes. These are the plain facts, which I beg most respectfully to bring before your Committee, and should esteem it a great favour if I might be allowed to appear before them to make any further explanation necessary.—Truly yours,

"WM. PIGOTT, Managing Director to the Farmers' Co.

"H. M. Jenkins, Esq., 12, Hanover Square, W."

Moisture	12·06
Oil	7·67
*Albuminous compounds	21·69
Mucilage, &c.	36·89
Woody fibre	10·53
†Mineral matter	11·16
	100·00
* Containing nitrogen	3·47
† Including sand	6·63

On Dr. Voelcker asking for particulars as to the cake, he received the following reply:—

"The Grange, Ulceby, February 18th, 1885.

"DEAR SIR,—I have had a very satisfactory explanation from the makers of the cake, and therefore need not trouble you further in the matter.—Yours truly, JOHN TURNER, per J. S. T."

7. Mr. W. Wood, of Habro, Ulceby, sent on February 17th three linseed-cakes for analysis.

The results were:—

	No. 1.	No. 2. Branded pure.	No. 3. Branded pure.
Moisture	14·33	13·48	13·07
Oil	10·13	8·17	8·10
*Albuminous compounds	25·77	24·03	22·62
Mucilage, &c.	33·80	38·73	40·58
Woody fibre	7·83	8·40	8·57
Mineral matter	8·14	7·19	7·06
	100·00	100·00	100·00
* Containing nitrogen	4·12	3·84	3·62

"J. AUGUSTUS VOELCKER."

And Dr. Voelcker wrote:—

"February 23rd, 1885.

"DEAR SIR,—Of the three cakes, No. 1 is decidedly the best. It is the highest in oil and in albuminous compounds, and although not as pure as it should be, it is in this respect far superior to the other two, both of which contain starchy impurities and foreign seeds in large quantity; they are also low in oil and in albuminous bodies, especially No. 3.—Yours faithfully,

"W. Wood, Esq. J. AUGUSTUS VOELCKER."

Mr. Wood, in reply to further enquiries, wrote:—

"Habrough, Ulceby, Lincolnshire, February 28th, 1885.

"DEAR SIR,—In answer to your letter about the linseed-cake, I have settled the matter with the makers to my satisfaction, and as they are personal friends of mine, I do not wish to expose them.—I am, yours truly,

"W. WOOD."

JUNE, 1885.

The following cases were reported :—

1. On February 21st, Mr. George King sent on behalf of Lord Braybrooke, Wokingham, Berks, a sample of linseed-cake, of which two tons had been purchased from an agent, at 9*l.* 10*s.* per ton.

Dr. Voelcker's analysis and report were :—

"February 25th, 1885.

Moisture	12·43
Oil	11·07
*Albuminous compounds	18·12
Mucilage, &c.	41·97
Woody fibre	9·33
Mineral matter	7·08
	100·00
* Containing nitrogen	2·90

"DEAR SIR,—This is a shamefully adulterated cake, full of a variety of foreign matters such as locust bean, cotton-seed husk, niger seed, rice and other starchy bodies in abundance. Was it sold to you as pure?—Yours faithfully, J. AUGUSTUS VOELCKER."

"G. King, Esq."

On enquiry it was found that no guarantee of purity had been given, the purchaser relying on the statement of the vendor that "it was good linseed-cake, and he had been selling a lot of it." This case was settled by payment of 6*l.* per ton for the cake.

2. Mr. J. Tillott, of White House, Yaxley, Eye, Suffolk, purchased on February 22nd, five tons of what was invoiced as "pure dissolved bones," the vendors and manufacturers being Stevens' Chemical Manure Company, Limited, 33, Mark Lane, E.C., and the price 7*l.* 4*s.* per ton for cash.

Dr. Voelcker's analysis of a sample sent on February 27th, was :—

Moisture	14·87
*Organic matter	28·85
Monobasic phosphate of lime	12·91
Equal to tribasic phosphate of lime rendered soluble by acid	(20·22)
Insoluble phosphates	3·59
Sulphate of lime, alkalies, &c.	33·25
Insoluble siliceous matter	6·53
	100·00
* Containing nitrogen	1·95
Equal to ammonia	2·37

And he reported:—

"This manure is not what it professes to be, viz., pure dissolved bones, for the nitrogen is largely derived from sources other than bone. The price of it, 7*l*. 4*s*. per ton, is considerably in excess of what it should be. 6*l*. per ton, exclusive of carriage, is ample for such a manure, which is a mixture of dissolved bones with other materials."

A circular sent by the vendors contained the following statements:—

"Pure dissolved bones—guaranteed to be composed entirely of bones dissolved in acid. Guaranteed analysis—20 to 21 per cent. soluble phosphate; 10 to 11 per cent. softened bone phosphate; and 3 to 4 per cent. ammonia."

The manure was invoiced as pure dissolved bones at 9*l*. per ton, 20 per cent. discount being offered, thus bringing the price to 7*l*. 4*s*. per ton, carriage paid.

The purchaser in order to secure the discount sent a cheque for 31*l*. 10*s*., on account, and this was ultimately accepted by the vendors as payment in full.

3. Mr. Henry Rogers, of Cheswell Grange, Newport, Salop, sent, on April 27th, a sample of bone-meal for analysis, two tons of which had been purchased from the Cannock Agricultural Co., Ld., Cannock, Staffs—H. R. Hart, manager, invoiced as "pure bone-meal," at 7*l*. 10*s*. per ton at works.

Dr. Voelcker's analysis and report were:—

Water	14·29
*Organic matter	30·49
Phosphate of lime	40·41
Carbonate of lime, &c.	5·77
Chloride of sodium (common salt)	8·17
Insoluble siliceous matter	0·87
	100·00
* Containing nitrogen	3·28
Equal to ammonia	3·98

"This is not a pure sample of bone-meal, being adulterated to a considerable extent with common salt. J. Augustus Voelcker."

The manager, in answer to Mr. Rogers's complaint, wrote:—

"Cannock, Staffordshire, May 6th, 1885.

"Dear Sir,—As I am called away unexpectedly into Norfolk through the illness of a relative, and it is uncertain of my being able to be at Newport on Monday, I have the pleasure of sending you copies of analyses of our bone-meal by Mr. Jones and Professor Sibson; the former is of the sample taken from your bags, the other from a sample fairly drawn from the bulk at the works. The difference between the two is accounted for by the first sample having been partly drawn from the bag, which had got wet. As regards the salt, I contend that it is quite incorrect to speak of it as an adulteration. It was added with no such object, but simply as an antiseptic, and under the advice of Professor Sibson, who assures me that, instead of being injurious, it is an improvement to the manure.

"When you have received Dr. Voelcker's analysis I shall be glad to see it; I feel assured that it cannot be such as to justify the hasty condemnation conveyed by his letter.—Yours faithfully, HENRY R. HART."

"Henry Rogers, Esq., Cheswell Grange, Newport, Salop."

[COPY.]

"Public Analyst's Laboratory, 10, Victoria Street,
"Wolverhampton, April 29th, 1885.

"Certificate to Messrs. The Cannock Agricultural Co., Ld., Cannock.

"Sample of bone-meal received by post yesterday under seal, 'H.R.' in red wax.

Moisture at 212° F.	13·30
*Organic matter	30·20
Tribasic phosphate of lime	42·52
Carbonate of lime	4·39
Common salt, magnesia, &c.	8·84
Insoluble siliceous matter	0·75
	100·00
* Yields ammonia	4·07

"With the exception of a little common salt, this is a genuine bone-meal.
"(Signed) E. W. T. JONES, F.I.C."

Ultimately an allowance of 10*s.* per ton was made.

4. Mr. G. Ingram, agent for Mr. J. C. Burton Borough, of Chetwynd Park, Newport, Salop, also purchased 20 tons of bone-meal from the Cannock Agricultural Company, this being invoiced as "pure bone-meal," at 7*l.* 15*s.* per ton nett. Being dissatisfied with the general appearance of the manure, Mr. Ingram deemed it advisable to consult Dr. Voelcker, who sent the following analysis and report:—

"May 6th, 1885.

Water	13·95
*Organic matter	30·35
Phosphate of lime	38·81
Chloride of sodium (common salt)	8·03
Carbonate of lime, &c.	8·12
Insoluble siliceous matter	0·74
	100·00
* Containing nitrogen	3·22
Equal to ammonia	3·91

"This bone-meal is adulterated with common salt to the extent of 8 per cent. J. AUGUSTUS VOELCKER."

In reply to further enquiry, Dr. Voelcker wrote:—

"May 9th, 1885.

"DEAR SIR,—I am much obliged for your kind reply and enclosures. As regards the value of manure, though I do not know exactly what the carriage amounts to, I may say that 7*l.* 15*s.* per ton nett cash is too dear for such a sample, which, independent of carriage, is not worth above 6*l.* 10*s.* a ton for cash.—Yours faithfully, J. AUGUSTUS VOELCKER."

"G. Ingram, Esq."

And Mr. Ingram replied :—

"Chetwynd Park, Newport, Salop, May 21st, 1885.

"Dr. Voelcker.

"DEAR SIR,—I beg to acknowledge receipt of yours of the 20th instant. A meeting of farmers, who had purchased bone-meal from The Cannock Agricultural Company, was held at Newport, on Monday, the 11th instant, and at which it was unanimously decided to claim 10*s*. per ton for the adulteration of their bone-meal, and this the Company, through their agent (who was present), agreed to allow, and thus the transaction ended. Thanking you for your trouble in the matter, I remain, yours faithfully,

"GEO. INGRAM."

5. Mr. J. M. Griffiths, of Caunsall House, Cookley, Kidderminster, sent, on May 8th, a sample of blood and bone manure for analysis. Two tons had been purchased from an agent, at 5*l*. 15*s*. per ton, less 15*s*. per ton for cash. The agent represented it as being worth more money than he was asking for it, but he did not guarantee it. Dr. Voelcker's analysis and report on the sample sent him were :—

BLOOD AND BONE MANURE.

"May 23rd, 1885.

Moisture	33·83
*Organic matter	25·30
Phosphate of lime	4·11
Carbonate and sulphate of lime, alkalies, &c.	21·94
Insoluble siliceous matter	14·82
	100·00
* Containing nitrogen	2·22
Equal to ammonia	2·69

"This is not worth more than 3*l*. a ton delivered.

"J. AUGUSTUS VOELCKER."

In answer to enquiries, Mr. Griffiths wrote on June 20th as follows :—

"Dr. J. A. Voelcker.

"DEAR SIR,—Yours to hand of yesterday. As regards the manure, I have only the agent's word that he will allow me if the manure does not grow a good crop. That seems a poor settlement; but as I have paid for it, I cannot do anything now, so I shall have to trust to him.—Yours respectfully,

"J. M. GRIFFITHS."

6. Mr. J. P. Harvey, of Honeybrook Farm, Franche, Kidderminster, sent also a sample of blood and bone manure for analysis, for which he said he was giving 7*l*. per ton, less 5 per cent., or 6*l*. 13*s*. nett, adding that it was sold to him as made from bone and blood only, and as not containing phosphate derived from coprolites. Dr. Voelcker reported as follows :—

"May 6th, 1885.

Water	22·07
*Organic matter	21·74
Monobasic phosphate of lime	4·76
Equal to tribasic phosphate of lime, rendered soluble by acid	(7·46)
Insoluble phosphates	3·24
Sulphate of lime, alkaline salts, &c.	42·25
Insoluble siliceous matter	5·94
	100·00
* Containing nitrogen	1·74
Equal to ammonia	2·11

"This is sold at double its worth. I would not give more than 3*l.* 5*s.* a ton for such a manure. J. AUGUSTUS VOELCKER."

In answer to enquiries, Mr. Harvey wrote:—

"Honeybrook Farm, Kidderminster, May 20th, 1885.

"Dr. J. Augustus Voelcker.

"DEAR SIR,—Am obliged for your enquiries concerning the manure you analysed, but have arranged the matter with the seller, so that there will be no further trouble.—Yours very truly, J. P. HARVEY."

7. Mr. R. Graham, of Melmerby-by-Penrith, sent, on May 13th, a sample of what had been sold to him as dissolved bones at 6*l.* 10*s.* a ton. Dr. Voelcker reported on it as follows:—

"May 21st, 1885.

Moisture	16·72
*Organic matter and salts of ammonia, &c.	14·55
Monobasic phosphate of lime	13·14
Equal to tribasic phosphate of lime rendered soluble by acid	(20·58)
Insoluble phosphates	3·89
Sulphate of lime, &c.	45·31
Insoluble siliceous matter	6·39
	100·00
* Containing nitrogen	1·49
Equal to ammonia..	1·80

"This is not dissolved bones at all, but a mineral superphosphate mixed with sulphate of ammonia, and is not worth 5*l.* a ton, independent of carriage. J. AUGUSTUS VOELCKER."

Subsequently Mr. Graham wrote:—

"Melmerby, near Penrith, June 4th, 1885.

"DEAR SIR,—In reply to yours of the 27th, I am sorry I cannot get such information respecting the dissolved bones as you ask for. I may say, however, it was sold as pure bone dissolved, had to contain $2\frac{1}{2}$ or $2\frac{3}{4}$ ammonia,

about 20 per cent. of soluble phosphate, and 10 to 12 insoluble. Moreover, it was bought from a London firm.

"In the stage in which the matter now stands I cannot give you further particulars.—Yours truly, R. GRAHAM.

"Dr. J. A. Voelcker, London."

A large number of cases have occurred in which decorticated cotton-cake has been sold which has been so hard-pressed as to be unfit for giving to stock, unless after being ground into quite a fine meal. In several of these cases analysis has shown that the decorticated cotton-cake instead of containing, as a good cake should, about 14 per cent of oil, has had as little as 7 or 8 per cent. The vendors complain that on account of the value of the oil no expense is spared by the Americans in pressing it out as much as possible, and hence decorticated cotton-cake is year by year made harder. In one case the purchaser says, "the cake is so awfully hard that the cattle cannot eat it." In a second case, cattle and sheep which had previously been feeding on decorticated cotton-cake refused a new lot of cake, and five days later two Guernsey calves died. The stomachs were found much inflamed, and the cake was hard like a stone. In a third case several calves had died; the cake given was found, on analysis, to contain only 7·83 per cent. of oil.

DECEMBER 1885.

Dr. Voelcker reported the following cases:—

1. On July 17th, 1885, Mr. John Oldrin, Rushmere, near Lowestoft, sent a sample of linseed-cake, branded "Pure," of which the analysis proved to be:—

Moisture	10·98
Oil	11·37
*Albuminous compounds	26·88
Mucilage, &c.	28·80
Woody fibre	7·90
†Mineral matter	14·07
	100·00
* Containing nitrogen	4·30
† Including sand	7·78

Dr. Voelcker reported it to have "a very large and objectionable amount of sand, besides other impurities."

The price was 8*l.* 12*s.* 6*d.* per ton. The only further information that could be obtained was that the cake came from Hull.

2. Mr. J. A. Goodwin, of Henhull Farm, Nantwich, sent on

August 19th, 1885, a sample of linseed-cake, which was analysed and reported on thus :—

Moisture	11·67
Oil	11·27
*Albuminous compounds	24·69
Mucilage, &c.	33·52
Woody fibre	8·07
†Mineral matter	10·78
	100·00
* Containing nitrogen	3·95
† Including sand	5·19

"This cake contains a large quantity of sand and is low in nitrogen.
"J. AUGUSTUS VOELCKER."

Inquiry elicited that the cake had been purchased through the Cheshire, Shropshire, and North Wales Farmers' Supply Association, Limited, Cheerbrook, Nantwich, of which Association Mr. Goodwin was a member, at 8*l.* 15*s.* per ton. Two tons were invoiced to the Association by the manufacturer at 7*l.* 15*s.* per ton—half a ton of this going to Mr. Goodwin.

The order form of the Association bears the following note :—

"It is distinctly understood that these goods are purchased with a strict guarantee as to purity, and subject to the analysis of Professor Voelcker, the Analytical Chemist to the Association."

3. Mr. R. Armstrong, of Scarcliffe Lanes, Mansfield, sent a sample of linseed-cake on September 12th, 1885, thirty tons of which had been bought from a dealer in Nottingham, as 'Pure linseed-cake,' 95 per cent. purity, at 8*l.* 2*s.* 6*d.* per ton. As the name of the manufacturer could not be obtained, the vendor's is, under the circumstances, withheld. The analysis and report were :—

Moisture	10·45
Oil	11·33
*Albuminous compounds	27·25
Mucilage, &c.	33·14
Woody fibre	8·53
†Mineral matter	9·30
	100·00
* Containing nitrogen	4·36
† Including sand	4·05

"This cake contains an excessive amount of sand, and has also a considerable quantity of other foreign material—it is an impure cake.
"October 9th, 1885. J. AUGUSTUS VOELCKER."

The cake was returned to the seller.

4. Mr. W. Perkins, of Thorney, Peterborough, sent on October 13th, 1885, a sample of linseed-cake, five tons of which had been bought from Messrs. Lenton and Son, Oundle, at 8*l.* 2*s.* 6*d.* per ton, delivered.

The cake was branded "J. E. and S. pure," and with it the following circular was given:—

"John Ellershaw and Sons, Oil Mills, Hull, beg to call attention to Mr. Carr Robinson's Analysis and Report of their linseed-cake.

"'Copy of Letter and Analysis of "J. E. and S. Pure" Linseed-cake.

"'DEAR SIRS,—This is a *pure* cake of good-class quality. It is made from well-screened seed, and is remarkably free from other foreign seeds. It contains a good average proportion of *oil*, and *flesh-forming matters* are well represented in it.

"'G. CARR ROBINSON, F.R.S.E., F.I.C., F.C.S.,
"'Lecturer on Chemistry and Technology, Hull.'"

IN 100 PARTS.

Moisture	12·11
Oil	10·79
*Albuminous compounds (flesh-forming matters)	26·39
Mucilage, sugar and digestive fibre	29·68
Woody fibre (cellulose)	13·66
Mineral matter (ash)	7·37
	100·00
* Containing nitrogen	4·17

Dr. Voelcker's analysis and report were:—

"October 21st, 1885.

Moisture	12·33
Oil	9·70
*Albuminous compounds	23·56
Mucilage, &c.	33·11
Woody fibre	12·07
†Mineral matter	9·23
	100·00
* Containing nitrogen	3·77
† Including sand	4·09

"This is a cake of inferior quality, and contains a considerable admixture of foreign seeds and sand. J. AUGUSTUS VOELCKER."

5. Mr. J. Bennington, Southfield House, North Dalton, Hull, purchased, on October 3rd, one ton of linseed-cake of Mr. G. Foster, Corn Merchant, Market Weighton, at 8*l.* per ton, the cake being branded "J. E. and S. pure," and invoiced

"pure." On sending a sample for analysis, Dr. Voelcker reported :—

"November 10th, 1885.

Analysis.

Moisture	13·07
Oil	10·13
*Albuminous compounds	23·37
Mucilage, &c.	35·03
Woody fibre	9·17
†Mineral matter	9·23
	100·00
* Containing nitrogen	3·74
† Including sand	4·34

"A dirty impure cake, very low in nitrogen.

"J. AUGUSTUS VOELCKER."

6, 7, 8, 9. These are four cases of purchases of a manure called "Sootigine," or soot and sewage manure, sold in truckloads at 35*s.*, in bags at 40*s.*, per ton on rail in London, and manufactured by the New Carbolic Sanitary Co., Ld., London Works, Hackney Downs Railway Station, E. A circular issued by the Company, and sent to each purchaser, asserts that the manure is equal to Peruvian Guano, and gives the following :—

"Analytical Report by Dr. Stevenson Macadam, F.R.S.E., F.C.S., F.I.C., &c., Lecturer on Chemistry and Consulting Analytical Chemist, Surgeons' Hall, Edinburgh.

"'Analytical Laboratory, Edinburgh, January 29th, 1885.

"'I have carefully analysed a sample of "Sootigine" manure from bulk, forwarded to me by the New Carbolic Sanitary Company, Limited, Hackney Downs Railway Station, London, E., and have obtained the following results :—

Moisture	24·92
*Organic matter and ammonia	16·84
Alkaline salts	5·32
Phosphates	12·16
Carbonate of lime	30·04
Silica	10·72
	100·00
* Ammonia	2·64

"'This manure is in excellent mechanical condition, and is of average quality in fertilising products.

"'STEVENSON MACADAM, Ph.D., &c.
"'Lecturer on Chemistry.'"

Similar analyses have been made by Mr. Nichells, of Leadenhall Street, London, and Mr. Jos. Mellor, County Analysts, Hemel Hempstead.

Mr. Henry Wing, of Church Farm, Liphook, Hants, bought on June 25th, 26 bags containing 2 tons 2 cwts. 7 lbs., at 2*l.* 10*s.* per ton, delivered to Liphook Station, through Mr. Henry Clark, of Fareham. Dr. Voelcker reported on a sample of it as follows:—

"August 13th, 1885.

Moisture	10·90
*Organic matter	24·87
Oxide of iron and alumina	18·06
Carbonate of lime	14·37
Phosphate of lime	traces
Alkalies, &c.	3·46
Insoluble siliceous matter	28·34
	100·00
* Containing nitrogen	·51
Equal to ammonia	·62

"This is rubbish sold at an extravagant price.

"J. AUGUSTUS VOELCKER."

Ultimately the matter was settled by Mr. Wing paying 1*l.* per ton.

Mr. T. R. Hulbert, of North Cerney, Cirencester, purchased on September 28th, 7 tons 14 cwts. of the same manure through Messrs. White and Co., of Gloucester, at 35*s.* per ton. A sample sent was reported on thus:—

"October 28th, 1885.

Water	10·97
*Organic matter	33·24
Phosphate of lime	·96
Oxide of iron and alumina	8·44
Carbonate and sulphate of lime, &c.	26·19
Insoluble siliceous matter	20·20
	100·00
* Containing nitrogen	·83
Equal to ammonia	1·07

"Not worth above a third of its price. J. AUGUSTUS VOELCKER."

Mr. F. Sherborn, Bedfont, Hounslow, bought on May 7th, 10 tons of the same manure from the Company, at 40*s.* a ton, with 2½ per cent. discount. Dr. Voelcker reported on a sample of it:—

Moisture	9·33
*Organic matter	26·97
Phosphate of lime	1·44
Oxide of iron and alumina	16·14
Carbonate and sulphate of lime, &c.	17·60
Insoluble siliceous matter	28·52
	100·00
* Containing nitrogen	·54
Equal to ammonia	·65

"Not worth more than a third of what it costs.

"J. Augustus Voelcker."

Mr. Algernon Fawkes sent on October 31st, on behalf of Lord Vernon, Sudbury Hall, Derby, a sample of the "Sootigine," one truck-load having been ordered by his Lordship at the Company's Stand at the Dairy Show, Agricultural Hall, London. However, 9 tons arrived in two trucks, invoiced at 40*s*. a ton, and one-half had to be returned. The report and analysis were:—

"October 31st, 1885.

Moisture	10·48
*Organic matter	24·60
Oxide of iron and alumina	11·22
Phosphate of lime	traces only
Carbonate of lime	24·15
Alkalies, magnesia, &c.	4·90
Insoluble siliceous matter	24·65
	100·00
* Containing nitrogen	·69
Equal to ammonia	·83

"This has turned out, as I expected, to be rubbish, worth a few shillings a ton only.

J. Augustus Voelcker."

ADDITIONS TO THE LIBRARY IN 1885.

I.—PERIODICALS PRESENTED TO THE SOCIETY'S LIBRARY.

Presented by the respective Societies and Editors.

A.—English, American, and Colonial Periodicals.

Agricultural Department, Annual Report for 1884, with Appendix. 1885.
Agricultural Departments of Foreign Countries, Reports of. 1885.
Agricultural Economist. Vol. XVII. 1885.
——— Gazette. 1885.
————— Almanack. 1886.
Agricultural Produce Statistics.—Tables showing the extent in statute Acres and the estimated average produce per Acre of the principal Crops for 1885.
Agricultural Returns of Great Britain. 1885.
——— Statistics, Ireland. 1885.
Arboricultural Society, Transactions of the English. Vol. I. Part II. 1885.
Athenæum. 1885.

Bath and West of England Society, Journal of the. 1884–5.
Bell's Weekly Messenger. 1885.
Bristol Mercury. 1885.

Calcutta: the Indian Agricultural Gazette. 1885. 8 Parts.
California, Annual Report of the State Board of Horticulture of. 1883.
Canada, Report of the Minister of Agriculture of the Dominion of, for 1884.
Cleveland Bay Stud Book. Vol. II. 1885.
Clydesdale Stud Book. Vol. VII. 1885.
Coates's Herd Book. Vol. XXXI. 1885.
County Gentleman. Vol. XXIII. 1885.

Economist. Vol. XLIII. 1885.
Essex Standard. 1885.
English Guernsey Cattle Society. Vol. I.

Farm and Home. 1885.
Farmer. 1885.
Farmer's Advocate. Vol. XIX. 7 Parts.
Farmer's Herald. 1885.
Field. 1885.

Galloway Cattle Society's Herd Book. Vols. III., IV., and V.
Geological Society, Journal of the. Vol. XLI. 1885.

Hackney Stud Book. Vol. II. 1885.
Hereford Cattle, Herd Book of. Vol. XV. Part II.
Highland and Agricultural Society of Scotland, Transactions of the. Vol. XVII. 1885.

Illustrated Journal of Agriculture, Montreal. 1885.
Institution of Civil Engineers, Proceedings of the. 4 Vols. 1885.
——— of Mechanical Engineers, Proceedings of the. 1885.
——— of Surveyors, Transactions of the. Vol. XVII. 1885.
Irish Farmer's Gazette. 1885.
Ironmonger. 1885.

Journal of Forestry. Vol. IX. 1884–5.

Land Agents' Record. 1885.
Live-Stock Journal. 1885.
——— ——— Almanac. 1886.

Manitoba, Report of the Department of Agriculture, &c., of, for 1882–3.
Manchester Literary and Philosophical Society, Memoirs of the. Vol. VIII., 1884.
——— Proceedings of the. Vols. XXIII. and XXIV.
Mark Lane Express and Agricultural Journal. 1885.
Meteorological Record. 1885. 3 Parts.
——— Society, Quarterly Journal of the. 1885.
Midland Counties' Herald. 1885.
Michigan, Reports of the State Board for, 1881–2 and 1883. 2 Vols.

National Pig-breeders' Association Herd Book. Vol. I. 1885.
Nature. 1885.
Newcastle Courant. 1885.
Newcastle Farmer's Club, Journal of the. 1885.
North British Agriculturist. 1885.

Ontario, Annual Report of the Bureau of Industries of the Province of. 1884.

Pennsylvania, Reports of the State Board, for 1884.
Polled Herd Book. Vol. IX. 1885.
Prairie Farmer. 1885.

Queensland, Statistics of the Colony of. 1884.

Royal Dublin Society, Scientific Transactions of the. Vol. III. Second Series. November and July 1884, and February 1885.
——— Scientific Proceedings of the. Vol. IV. 5–6.
Royal Geographical Society, Proceedings of the. 1885.
Royal Institution of Great Britain, Proceedings of the. Vol. XI. 1884–5.
Royal Society of New South Wales, Journal of the. 1884.
Royal United Service Institution, Journal of the. 1885.

Shire-horse Stud Book. Vol. VI. 1885.
Shropshire Sheep Breeders' Flock Book. Vols. I. and II.
Society of Arts, Journal of the. 1885.
Statistical Society, Journal of the. 1885.
Sussex Association for the Improvement of Agriculture. Annual Report, Season 1884.

Trade and Navigation of the United Kingdom, Accounts relating to the. 1885.

Veterinarian, The. 1885.
Veterinary Journal. 1885.

B. List of Foreign Periodicals.

Berlin. Landwirthschaftliche Jahrbücher. Band XIV. Hefte 1–4. Supplement II., 1885.
——. Journal für Landwirthschaft. 1885. Hefte 1–2.
Brussels. Journal de la Société centrale d'Agriculture de Belgique. 1885. 2 Parts.
Bulletin de l'Agriculture. 1885. 4 Parts.
Buenos Aires. Anales de la Sociedad rural Argentina. Vol. XIX. 1885.
————. Annuaire statistique de la Province de, pour 1883. 1885.
————. Comercio de la Provencia de Santa-Fé.
Christiania. Beretning om det Kgl. Selskab for Norges Veldets Tilstand og Virksomhed in Aaret 1884.
Crosne. Le Poussin. 1885.
Forhandlinger ved Aarsmødet i Foreningen til Diskussion af Landbrugsanliggender.
Groningen. Handelingen van het Genootschap van Nijverheid in de Provincie Groningen. 1884–5.
Habana. Boletin de la Sociedad Protectora de Animales y Plantas de la Isla de Cuba. 1885. 5 Parts.
Hanover. Jahresbericht der königlichen Landwirthschafts-Gesellschaft zu Celle: Central-Verein für die Provinz Hannover für 1885.
———. Protokolle der Sitzungen des Central-Auschusses der königlichen Landwirthschafts-Gesellschaft. 1885.
Kiel. Landwirthschaftliches Wochenblatt für Schleswig-Holstein. 1885.
Meaux. Publication de la Société d'Agriculture, Sciences, et Arts de. 1884.
Moscow. Bulletin de la Société Imperiale des Naturalistes. 1884.
Munich. Zeitschrift des landwirthschaftlichen Vereins in Bayern. 1884.
Paris. Annales Agronomiques. Tome 11^{me}. Nos. 1–12. 1885.
——. Bulletin des Séances de la Société nationale d'Agriculture de France. 1885.
——. Journal d'Agriculture Pratique. 1885.
——. Journal de l'Agriculture. 1885.
——. Bulletin de la Société des Agriculteurs de France. 1885.
——. Ministère de l'Agriculture. Bulletin. 1885. Nos. 1–8.
Rome. Annali di Agricoltura. 15 Parts. 1885.
——. Bollettino di Notizie Agrari. 1885.
——. Esposizione d'Igiene a Londra nell' anno. 1884.
—— Notizie sulla Agricolture in Italia.
Rouen. Extrait des travaux de la société centrale d'agriculture du Département de la Seine-Inférieure. 1885. 2 Parts.
Stockholm. Kongl. Landtbruks-Akademiens Handlingen och Tidskrift. Nos. 1–6. 1885.
Strasbourg. Bulletin Mensuel de la Société des Sciences, &c., de la Basse-Alsace. Vol. XIX. 1885. 7 Parts.
Valenciennes. Revue agricole de la Société d'Agriculture, sciences, et arts de l'arrondissement de Valenciennes. 1885. 5 Parts.

II.—BOOKS PRESENTED OR OTHERWISE ADDED TO THE SOCIETY'S LIBRARY.

Names of Donors in Italics.

A. English, American, and Colonial Books and Pamphlets.

Agricultural Department of the Privy Council:—Returns of the replies to questions relating to silos and ensilage by the Agricultural Department, Privy Council Office, to persons who have silos in Great Britain, with their Observations. 1885.

———————————. Reports on Insects injurious to Hop Plants, Corn, and Fruit Crops in Great Britain, prepared for the Agricultural Department, by Charles Whitehead. 1885. Vols. I. and II. (the same books also presented by the Author).

Dickson and Sons. Hardily Grown Forest Trees. 1885–6.

———————. Select Farm Seeds, with original illustrations of the "Grasses of the Field."

Ellis, G. H. Remarks upon sewage and water purification in relation to public health.

First National Convention of Cattlemen, Proceedings of the, held in St. Louis, November, 1884.

Great Eastern Railway Company. Poppy Land. By Clement Scott.

Handbook of the Farm Series. Animal Life on the Farm, by Professor Brown; and Dairy of the Farm, by James Long and J. C. Morton.

Institution of Civil Engineers. Heat and its Mechanical Applications, a series of Lectures delivered at the. 1883–4.

———————. Theory and Practice of Hydro-Mechanics, a series of Lectures delivered at the. 1884–5.

———————. Index, Vols. I. to LVIII.

———————. Charter, By-Laws, and List of Members.

Madras Agricultural Exhibition. 1883. Essays on the Management of Soils under Coffee, &c., in the Madras Presidency.

—— On the Utilization of Irrigation Waters.

—— On the Best Method of Planting Fuel Plantations in India, Madras. 1885.

Revenue Settlement and Agriculture. Annual Report of the Department, Madras. 1885.

———————————. *Forest Department.* Annual Administrative Reports for 1832–3, and 1883–4, 2 Parts, Madras. 1884.

Roth, H. Ling:—

Agricultural Class Book. Dublin, 1849.

Baker, T. Rudimentary Treatise on Land and Engineering Surveying. London, 1875.

Brown, J. C. Forests and Moisture, or Effects of Forests on Humidity of Climate. London, 1875.

Doyle, Martin. Small Farms, and how they ought to be managed. London.

Fowler and Co. On the Working of Double Engine Steam Ploughing Machinery. Leeds, 1874.

Gilbert, Dr. J. H. Notes on Clover Sickness.

——————. Note on the occurrence of "Fairy-Rings."

Johnson, Samuel W. How Crops grow: a treatise on the Chemical Composition, Structure, and Life of the Plant. New York.

Johnston, J. F. W. Catechism of Agricultural Chemistry and Geology. 1872.

Roth, H. Ling:—

Johnson, J. F. W., and Cameron, Charles A. Elements of Agricultural Chemistry and Geology. 1877.

Lawes, Sir J. B. Fertility. London, 1881.

———. On the more frequent growth of Barley on Heavy Land. London, 1875.

———. On the Valuation of Unexhausted Manures. London, 1875.

——— and Gilbert, Dr. J. H. Effects of the Drought of 1870 on some of the Experimental Crops at Rothamsted. London, 1871.

———. On the Home Produce, Imports, Consumption, and Price of Wheat over the Harvest years 1852–53 to 1879–80 inclusive.

———. Our Climate and our Wheat Crops. London, 1880.

———. Report of Experiments on the Growth of Barley for twenty years in succession on the same Land. London, 1873.

——— and R. Warington. On the Amount and Composition of the Rain and Drainage-Waters collected at Rothamsted.

Lawson, Wm., Hunter, C. D., and others. Ten years of Gentleman Farming. London, 1875.

Liebig, Justus von. Natural Laws of Husbandry. (Edited by John Blyth.) London, 1863.

———. Principles of Agricultural Chemistry, with special reference to the late researches made in England. London, 1885.

McIvor, R. W. Agricultural Chemistry. Brisbane, 1879.

Mackay, Angus. Semi-Tropical Agriculturist and Colonists' Guide. Brisbane, 1875.

Morton, John. Nature and Property of Soils. London, 1843.

———. Our Farm of four acres. London, 1872.

Roth, H. Ling. Animal Parasites of the Sugar Cane. 1885.

Schützenberger, P. On Fermentation. London, 1876.

Scote, John. Farm Roads, Fences, and Gates. London, 1883.

Simmonds, P. L. Waste Products and Undeveloped Substances. London, 1873.

Stephens, Henry. A practical system of Farm Book-keeping. 1868.

Stewart, Henry. Irrigation for the Farm Garden and Orchard.

Tanner, Henry. The Abbot's Farm, or Practice with Science.

Tull, Jethro. Husbandry (Preface by W. Cobbett).

Ville, Georges. On Artificial Manures (translated and edited by William Crookes). London, 1879.

Wilson, John. Our Farm Crops. 2 Vols.

Wurtz, A. Atomic Theory (translated by E. Cleminshaw). London, 1880.

Saunders, Lawrence. Robert Boyle, Inventor and Philanthropist. 1885.

Smithsonian Institution. Annual Report for 1883.

———. Publications of the Bureau of Ethnology.

———. Contributions to Knowledge. Vols. XXIV. and XXV.

Taylor, W. C. An Agricultural Note-Book. 1885.

United States Department of Agriculture. Report for 1884.

———. Special Reports, New Series, Nos. 5, 14, 15, 16–24.

Wallace, Professor. Farm Live Stock of Great Britain. 1885.

Warington, Robt. On the Action of Gypsum in promoting Nitrification. 1885.

B. Foreign Books and Pamphlets.

Barral, J. A. Dictionnaire d'Agriculture, encyclopédie agricole complète. 4 Parts.

Birkeland, M. Selskabet for Norges Vel. 1809–1829.

D'Orval, E. Hecquet. Agriculture de Basse-Picardie en 1884. Abbeville, 1885.

Eriksson, Jakob. Bidrag till Kännedomen om Våra Odlade Växters Sjukdomar. Stockholm.

Fleischmann, Prof. Dr. W. Bericht über die Wirksamkeit der Milchwirtschaftlichen Versuchs-Station und des Molkerei-Institutes Raden im Jahre 1884. Rostock, 1885.

Joly, Charles. Note sur les Eucalyptus Géants de l'Australie. Paris, 1885.

Laverrière, Jules. Essais entrepris en Angleterre pour régénérer la pomme de terre par voie d'hybridation. Paris, 1885.

Körnicke, Prof. Dr. Die Arten und Varietäten des Getreides. Bonn, 1885.

Roth, H. Ling :—

Candolle, A. Origine des Plantes cultivées. Paris, 1883.

De Cossigny, J. C. Notions élémentaires théoriques et pratique sur les Irrigations. Paris, 1874.

Engel, Friedrich. Der Pferdestall. Berlin, 1876.

Fischbach, Carl. Lehrbuch der Forstwissenschaft. Berlin, 1877.

Funk, Dr. V. Der Rindviehzucht. Berlin, 1876.

Gorufs-Besanez, Dr. E. F. v. Lehrbuch der Anorganischen Chemie. 2 Vols. Brunswick, 1862 and 1863.

Holdefleisz, Dr. Fr. Landwirthschaftliche Reiseskizzen aus England und Schottland. Berlin, 1876.

Klaeden, G. A. von. Handbuch der Physischen Geographie. 2 Vols. Berlin, 1872.

Kühn, Dr. Julius. Die zweckmässigste Ernährung des Rindviehes. Dresden, 1873.

Machts, Ferdinand. Der Landswirth als Forstmann. 1877.

Mayer, Dr. Adolf. Lehrbuch der Agrikulturchemie. Heidelberg, 1876.

Messler, Dr. J. Der Tabak. Mannheim, 1867.

Nobbe, Dr. Friedrich. Handbuch der Samenkunde. Berlin, 1876.

Raspail, F. v. Cours d'Agriculture et d'économie rurale. Paris, 1838.

Schumann, Dr. C. Anleitung zur Untersuchung der Künstlichen Düngemittel und ihre Rohstoffe. Brunswick, 1876.

Soraner, Dr. Paul. Handbuch der Pflanzenkrankheiten. Berlin, 1874.

Villeroy, F., et Muller, Adam. Manuel des Irrigations. Paris.

Von Babo, A., und Hoffacker, F. Der Tabaksbau.

Wagner, L. von. Handbuch der Stärkefabrikation.

———————— der Tabak- u. Cigarrenfabrikation.

Wolff, Emil. Praktische Düngerlehre.

Womacka, A. F. Die Erhaltung der Wälder.

Schmidt, Prof. Dr. Ackererde und Untergrund des Gutes Trubetsching. Dorpat, 1885.

Société Nationale d'Agriculture de France. Enquête sur le Crédit Agricole. Tome Second. Paris, 1885.

Thoms, Prof. G. Ein Roggen und ein Kartoffel Düngungs-Versuch. Mittheilung aus der Praxis. Riga, 1885.

Vilmorin, H. Céréales, plantes fourragères et économiques. Paris.

————. Essai d'un catalogue méthodique et synonymique des principales variétés de Pomme de Terre. Paris.

Werner, Dr. Hugo. Die Sorten und der Anbau des Getreides. Bonn, 1885.

Royal Agricultural Society of England.

1886.

President.

H.R.H. The PRINCE OF WALES, K.G.

Trustees.

Year when Elected.	
1879	H.R.H. The Prince of Wales, K.G., *Marlborough House, Pall Mall,* **S.W.**
1855	Acland, Sir Thomas Dyke, Bart., M.P., *Killerton, Exeter, Devonshire.*
1857	Bridport, General Viscount, K.C.B., *Cricket St. Thomas, Chard, Somersetshire.*
1861	Dent, J. D., *Ribston Hall, Wetherby, Yorkshire.*
1871	Egerton (of Tatton) Lord, *Tatton Park, Knutsford, Cheshire.*
1863	Kingscote, Col., C.B., *Kingscote, Wotton-under-Edge, Gloucestershire.*
1868	Lichfield, Earl of, *Shugborough, Staffordshire.*
1854	Macdonald, Sir Archibald Keppel, Bt., *Woolmer Lodge, Liphook, Hants.*
1839	Portman, Viscount, *Bryanston, Blandford, Dorset.*
1856	Powis, Earl of, *Powis Castle, Welshpool, Montgomeryshire.*
1858	Rutland, Duke of, K.G., *Belvoir Castle (Leicestershire), Grantham.*
1861	Wells, William, *Holmewood (Huntingdonshire), Peterborough.*

Vice-Presidents.

1873	Bedford, Duke of, K.G., *Woburn Abbey, Bedfordshire.*
1861	Cathcart, Earl, *Thornton-le-Street, Thirsk, Yorkshire.*
1867	Devonshire, Duke of, K.G., *Holker Hall, Lancashire.*
1847	Eversley, Viscount, G.C.B., *Heckfield Place, Winchfield, Hants.*
1848	Kerrison, Sir Edward C., Bart., *Brome Hall, Scole, Suffolk.*
1858	Lathom, Earl of, *Lathom Hall, Ormskirk, Lancashire.*
1872	Lawes, Sir John Bennet, Bart., *Rothamsted, St. Albans, Herts.*
1865	Lopes, Sir Massey, Bart., *Maristow, Roborough, Devon.*
1867	Ravensworth, Earl of, *Ravensworth Castle, Gateshead, Durham.*
1852	Richmond and Gordon, Duke of, K.G., *Goodwood, Chichester, Sussex.*
1874	Spencer, Earl, K.G., *Althorp, Northamptonshire.*

Other Members of Council.

1881	Allender, G. Mander, 31, *St. Petersburgh Place, Bayswater, Middlesex.*
1877	*Arkwright, J. Hungerford, *Hampton Court, Leominster, Herefordshire*
1880	Ashworth, Alfred, *Tabley Grange, Knutsford, Cheshire.*
1875	Aylmer, Hugh, *West Dereham, Stoke Ferry, Norfolk.*
1871	Bowen-Jones, J., *Ensdon House, Montford Bridge, R.S.O., Salop.*
1886	Caird, James A., *Northbrook, Micheldever, Hants.*
1874	Chandos-Pole-Gell, H., *Hopton Hall, Wirksworth, Derbyshire.*
1884	*Chaplin, Henry, M.P., *Blankney Hall, Lincoln.*
1883	*Clay, Charles, *Walton Grange, Wakefield, Yorkshire.*
1883	Coke, Hon. Edward K. W., *Longford Hall, Derbyshire.*
1885	Coventry, Earl of, *Croome Court, Severn Stoke, Worcestershire.*
1886	De Laune, C. de L. Faunce, *Sharsted Court, Sittingbourne, Kent.*
1860	*Druce, Joseph, *Eynsham, Oxford.*
1882	*Emlyn, Viscount, *Golden Grove, Carmarthen, S. Wales.*

* Those Members of Council whose names are prefixed by an asterisk retire by rotation in July but are eligible for re-election in May.

Year when Elected.	
1876	FEVERSHAM, Earl of, *Duncombe Park, Helmsley, Yorkshire.*
1879	*FOSTER, SAMUEL P., *Killhow, Carlisle, Cumberland.*
1875	*FRANKISH, WILLIAM, *Limber Magna, Ulceby, Lincolnshire.*
1881	*GILBEY, WALTER, *Elsenham Hall, Essex.*
1879	GORRINGE, HUGH, *Kingston-by-Sea, Brighton, Sussex.*
1874	*HEMSLEY, JOHN, *Shelton, Newark, Notts.*
1876	HOWARD, CHARLES, *Biddenham, Bedford.*
1878	*HOWARD, JAMES, *Clapham Park, Bedfordshire.*
1883	*JERSEY, Earl of, *Middleton Park, Bicester, Oxfordshire.*
1869	LEEDS, ROBERT, *Keswick Old Hall, Norwich.*
1881	LITTLE, HERBERT J., *Coldham Hall, Wisbech, Cambridgeshire.*
1885	LLOYD, ARTHUR P., *Leaton Knolls, Shropshire.*
1886	MAINWARING, C. S., *Galltfaenan, Rhyl, Denbighshire.*
1874	MARTIN, JOSEPH, *Highfield House, Littleport, Isle of Ely, Cambridgeshire.*
1884	MILLER, T. HORROCKS, *Singleton Park, Poulton-le-Fylde, Lancashire.*
1880	*MORETON, Lord, *Tortworth Court, Falfield, R.S.O., Gloucestershire.*
1886	*MUNTZ, PHILIP ALBERT, M.P., *Dunsmore, Rugby, Warwickshire.*
1879	*NEVILLE, ROBERT, *Butleigh Court, Glastonbury, Somersetshire.*
1881	PARKER, Hon. CECIL T., *Eccleston, Chester.*
1861	*RANDELL, CHARLES, *Chadbury, Evesham, Worcestershire.*
1871	*RAWLENCE, JAMES, *Bulbridge, Wilton, Salisbury, Wilts.*
1869	RIDLEY, Sir M. WHITE, Bart., *Blagdon, Cramlington, Northumberland.*
1875	RUSSELL, ROBERT, *Horton Court Lodge, Dartford, Kent.*
1874	*SANDAY, GEORGE H., *Langdale Lodge, Atkins Rd., Clapham Park, Surrey.*
1886	SCARTH, W. T., *Keverstone, Darlington.*
1878	*SHERATON, WILLIAM, *Broom House, Ellesmere, Salop.*
1882	*STAFFORD, Marquis of, M.P., *Trentham Hall, Stoke-upon-Trent, Staffs.*
1875	*STRATTON, RICHARD, *The Duffryn, Newport, Monmouthshire.*
1883	*SUTTON, MARTIN J., *Dyson's Wood, Kidmore, Reading, Berkshire.*
1881	*THOROLD, Sir JOHN H., Bart., *Syston Park, Grantham, Lincolnshire.*
1884	*VIVIAN, Sir H. HUSSEY, Bart., M.P., *Park Wern, Swansea, S. Wales.*
1871	WAKEFIELD, WILLIAM H., *Sedgwick, Kendal, Westmoreland.*
1882	*WARREN, REGINALD AUGUSTUS, *Preston Place, Worthing, Sussex.*
1870	*WHITEHEAD, CHARLES, *Barming House, Maidstone, Kent.*
1865	WILSON, JACOB, *Chillingham Barns, Belford, Northumberland.*

Secretary and Editor.

H. M. JENKINS, 12, *Hanover Square, London,* **W.**

Consulting Chemist—Dr. J. AUGUSTUS VOELCKER, 12, *Hanover Square,* **W.**

Consulting Botanist—W. CARRUTHERS, F.R.S., F.L.S., *Central House, Central Hill, Norwood,* **S.E.**

Consulting Entomologist—Miss E. A. ORMEROD, F.R.Met.Soc., *Dunster Lodge, Spring Grove, Isleworth.*

Consulting Veterinary Surgeon—Professor JAMES BEART SIMONDS, *St. John's Villa, Ryde, Isle of Wight.*

Veterinary Inspectors—THE OFFICERS OF THE ROYAL VETERINARY COLLEGE.

Consulting Engineer—W. ANDERSON, 3, *Whitehall Place,* **S.W.**

Surveyor and Superintendent of Works—WILSON BENNISON, 66, *Ashley Road, Crouch Hill,* **N.**

Consulting Surveyor—GEORGE HUNT, *Evesham, Worcestershire.*

Seedsmen—THOMAS GIBBS & CO., *Down Street, Piccadilly,* **W.**

Publisher—JOHN MURRAY, 50, *Albemarle Street,* **W.**

Bankers—THE LONDON AND WESTMINSTER BANK, *St. James's Square Branch,* **S.W.**

---

* Those Members of Council whose names are prefixed by an asterisk retire by rotation in July, but are eligible for re-election in May.

STANDING COMMITTEES FOR 1886.

Finance Committee.

KINGSCOTE, Colonel (Chairman).
BRIDPORT, General Viscount.
RIDLEY, Sir M. WHITE, Bt.
FRANKISH, W.
RANDELL, CHARLES.
SANDAY, G. H.

House Committee.

CHAIRMAN of Finance Committee.
THE PRESIDENT.
BRIDPORT, General Viscount.
RANDELL, C.
WILSON, JACOB.

Journal Committee.

CATHCART, Earl (Chairman).
JERSEY, Earl of.
EMLYN, Viscount.
THOROLD, Sir J. H., Bt.
BOWEN-JONES, J.
CAIRD, J. A.
DENT, J. D.
FRANKISH, W.
HOWARD, J.
LITTLE, H. J.
WELLS, W.
WHITEHEAD, CHARLES.

Chemical Committee.

WELLS, WILLIAM (Chairman).
BEDFORD, Duke of.
EMLYN, Viscount.
PARKER, Hon. C. T.
LAWES, Sir J. B., Bt.
MACDONALD, Sir A. K., Bt.
THOROLD, Sir J. H., Bt.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
CLAY, CHARLES.
DE LAUNE, C. DE L. FAUNCE.
DENT, J. D.
HOWARD, C.
LITTLE, H. J.
NEVILLE, R.
VOELCKER, Dr.
WAKEFIELD, W. H.
WARREN, R. A.
WHITEHEAD, CHARLES.

Seeds and Plant-Diseases Committee.

WHITEHEAD, CHARLES (Chairman).
CATHCART, Earl.
THOROLD, Sir J. H., Bt.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
CARRUTHERS, W.
DE LAUNE, C. DE L. FAUNCE.
FRANKISH, W.
LITTLE, H. J.
STRATTON, R.
SUTTON, MARTIN J.

Veterinary Committee.

THOROLD, Sir J. H., Bt. (Chairman).
EGERTON OF TATTON, Lord.
BRIDPORT, General Viscount.
MORETON, Lord.
COKE, Hon. E. K. W.
PARKER, Hon. C. T.
RIDLEY, Sir M. WHITE, Bt
ALLENDER, G. M.
ASHWORTH, A.
BROWN, Professor.
CHAPLIN, H.
COPE, A. C.
FLEMING, GEORGE.
FOSTER, S. P.
HARPLEY, M. J.
KINGSCOTE, Colonel.
LLOYD, A. P.
ROBERTSON, Professor.
SANDAY, G. H.
SIMONDS, Professor.
WAKEFIELD, W. H.
WILSON, JACOB.

Stock-Prizes Committee.

WILSON, JACOB (Chairman).
COVENTRY, Earl of.
BRIDPORT, Gen. Viscount.
MORETON, Lord.
EMLYN, Viscount.
COKE, Hon. E. K. W.
PARKER, Hon. C. T.
ALLENDER, G. M.
ARKWRIGHT, J. H.
ASHWORTH, A.
AYLMER, H.
BOWEN-JONES, J.
CHANDOS-POLE-GELL, H.
FOSTER, S. P.
FRANKISH, W.
GILBEY, WALTER.
GORRINGE, H.
HEMSLEY, J.
HOWARD, C.
MARTIN, J.
MILLER, T. H.
RANDELL, C.
SANDAY, G. H.
SHERATON, W.
SIMONDS, Professor.
STRATTON, R.
WAKEFIELD, W. H.
The Stewards of Live Stock.

Implement Committee.

HEMSLEY, J. (Chairman).
BRIDPORT, Gen. Viscount.
MORETON, Lord.
PARKER, Hon. C. T.
THOROLD, Sir J. H., Bt.
ALLENDER, G. M.
ANDERSON, W.
BOWEN-JONES, J.
CLAY, C.
FRANKISH, W.
HOWARD, C.
HOWARD, J.
LITTLE, H. J.
MARTIN, J.
NEVILLE, R.
SANDAY, G. H.
SHERATON, W.
STRATTON, R.
WILSON, JACOB.
The Stewards of Implements.

General Norwich Committee.

THE WHOLE COUNCIL, with the following representatives of the LOCAL COMMITTEE:—

LEICESTER, Earl of, K. G.
HENNIKER, Lord.
BARNARDISTON, N.
BIRKBECK, Sir EDWARD, Bt., M.P.
BULLARD, HARRY.
COLMAN, J. J., M.P.
ELLIS, JOHN.
HAMOND, A.
HOTBLACK, J.
NORFOLK, HIGH SHERIFF OF.
NORWICH, MAYOR OF.
NORWICH, TOWN CLERK OF.
READ, CLARE S.
TAYLOR, GARRETT.
YOUNGS, JOHN.

Show-Yard Contracts Committee.

RANDELL, CHARLES (Chairman).
ALLENDER, G. M.
ASHWORTH, A.
CLAY, CHARLES.
FRANKISH, W.
HEMSLEY, J.
HOWARD, C.
SANDAY, G. H.
WILSON, JACOB.

Committee of Selection.

CATHCART, Earl (Chairman).
COVENTRY, Earl of.
EMLYN, Viscount.
PARKER, Hon. C. T.
THOROLD, Sir J., Bt.
GORRINGE, H.
LITTLE, H. J.

And the Chairmen of the Standing Committees.

Education Committee.

MORETON, Lord (Chairman).
JERSEY, Earl of.
EMLYN, Viscount.
THOROLD, Sir J. H., Bt.
BOWEN-JONES, J.
DENT, J. D.
FOSTER, S. P.
KINGSCOTE, Colonel.
LITTLE, H. J.
SUTTON, M. J.
VOELCKER, Dr.

Dairy Committee.

PARKER, Hon. C. T. (Chairman).
BRIDPORT, Gen. Viscount.
EGERTON, Lord.
THOROLD, Sir J. H., Bt.
ASHWORTH, A.
ALLENDER, G. M.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
KINGSCOTE, Colonel
MAINWARING, C. S.
NEVILLE, R.
SHERATON, W.

Cattle Plague Committee.

THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Thursday, December 10th, 1885.

REPORT OF THE COUNCIL.

During the present year the changes which have occurred in the list of Members of the Society have been as follows:—1 Governor and 542 Members have been elected; 1 Member has qualified as a Governor; the deaths of 5 Governors and 123 Members have been reported; 178 Members have resigned; and 54 Members have been removed from the list by order of the Council.

The Society now consists of

73 Life Governors,
65 Annual Governors,
3382 Life Members,
5667 Annual Members,
20 Honorary Members,

making a total of 9207, and showing an increase of 183 during the year 1885.

Since the Annual Meeting in May the Council have lost the services of some of their most valued colleagues, by the death of Sir Brandreth Gibbs and Sir Watkin Wynn, Bart., Vice-Presidents, and of Mr. T. Pain, a Member of the Council; as

well as by the resignation of Mr. G. Wise, also a Member of the Council.

These vacancies and one existing at the date of the Annual Meeting have up to the present time been dealt with as follows:—The Earl of Ravensworth and Sir Massey Lopes, Bart., have been elected Vice-Presidents; and Mr. A. P. Lloyd, of Leaton Knolls, Salop, Mr. J. A. Caird, of Warren Farm, Micheldever, Hampshire, and Mr. Faunce De-Laune, of Sharsted Court, Kent, have been elected Members of the Council. Two other vacancies on the Council are still under consideration.

The half-yearly statement of accounts to the 30th June last has been examined and certified by the auditors and accountants of the Society, and has been published in the 'Journal' for the information of the Members. The funded capital of the Society remains the same as at the Annual Meeting in May, namely, 29,885*l.* 4*s.* 4*d.* New Three per Cents. The balance of the current account in the hands of the Society's Bankers on the 1st instant was 2569*l.* 15*s.* 9*d.*, and 2000*l.* remained on deposit.

The success of the Preston Meeting was considerable, in spite of the generally cold and wet weather which prevailed; and so far as can at present be ascertained, it has resulted in an excess of Receipts over Income Expenditure to the amount of about 2750*l.* A considerable addition to the permanent Plant was constructed and first used at Preston; it consisted chiefly of large and commodious buildings placed in the centre of the yard for the accommodation of the Council, Stewards, and other officers, as well as the Members of the Society.

The exhibition of Poultry at Preston—the first held by the Society since the Bury Meeting in 1867,—was a much greater success than could have been anticipated, considering the length of time which has elapsed since the Bury Show. The novel features in the Prize-sheet and in the Pens were well received

by the Exhibitors, and the Council trust that the Members will aid them in their effort to establish an annual Show of Farm Poultry at the Society's Country Meetings.

The Prizes and Certificates of Efficiency offered by the Council to makers of Butter and Cheese who should pass a practical examination in the Preston Showyard were competed for by only five Butter-makers and two Cheese-makers, but the Council hope that a repetition of the offer may attract a much larger number to the Examination at Norwich next July.

The Council have decided that the Norwich Meeting shall commence on Monday, July 12th, and close on the following Friday evening.

Prizes for the best-managed Farms in Norfolk and Suffolk have been offered by the Norwich Local Committee in four classes. Fourteen farms have been entered for competition, and the Judges appointed by the Council have already made their first inspection.

Although the Prizes offered at Preston for sets of Harness and Gears did not attract any entries, the Council have, on the recommendation of the Stewards and Judges, repeated the offer in connection with the Norwich Meeting. They have also decided to offer Prizes for the best apparatus for making thatch for the covering of stacks, and for the best substitute for straw thatch other than metal.

The Society's Schedule of Prizes for Live Stock has been arranged with a special view to the requirements of the Eastern Counties, in addition to the usual encouragement of the National breeds; and it has been supplemented by the Local Committee in several classes for Agricultural Horses, Hunters, Harness Horses, and Hackneys, as well as additional Classes and Champion Prizes for Suffolk Horses and Hackneys, Red Polled Cattle, and Suffolk Sheep. The Shire Horse Society has again

offered a Champion Prize for the best Shire Stallion in the Showyard, and Mr. H. Birkbeck for the best Hackney. The Shorthorn Society have also offered two Champion Prizes for the best male and the best female Shorthorn to be exhibited in the Norwich Showyard.

Invitations from the Authorities of Darlington and Newcastle to hold the Show of 1887 in those localities having been received by the Council, they have appointed a Committee of Inspection to visit and report upon the sites and other accommodation offered by each.

Thirty-six Silos have been entered to compete for the Prize of One Hundred Guineas offered by Sir Massey Lopes, when President of the Society, "for the best Silo in England or Wales in actual work during the winter of 1885–86;" and eleven Stacks have been entered to compete for the Prize of Twenty-five Pounds subsequently offered by the Council "for the best Ensilage Stack or other system for obtaining Silage without a Silo." The Judges appointed by the Council to award these Prizes have already made their first tour of inspection.

In the Chemical Department the analytical work conducted for Members of the Society has been nearly as extensive as last year, 1587 samples having been received for analysis.

In the last Report of the Council attention was called to the deterioration in quality of Linseed-cakes, owing to increased facilities for expressing the oil; the Consulting Chemist has since reported a decided improvement in the purity and richness of the Linseed-cakes submitted to him; but, on the other hand, he has pointed out that the same cause which deteriorated Linseed-cake applies now almost equally to Decorticated Cotton-cake, which is frequently of a very hard and often indigestible character through inferior manufacture and the application of great pressure.

In consequence of the alteration in the price of manures and feeding materials since the publication, nearly twenty-five years ago, of Sir John Lawes's Table of Manurial Values, Sir John Lawes and Dr. Gilbert drew up a revised Table at the request of the Chemical Committee, and this, with a valuable explanatory paper, has been published in the current number of the 'Journal.' This will be immediately republished as a pamphlet at 6*d.* each.

The Woburn Experiments have been continued as heretofore, with the addition of a fresh series on the comparative manurial values of Decorticated Cotton-cake and Maize-meal. A further set of feeding experiments on the value of Silage will also be conducted during the winter.

The Council having appointed a Special Committee to consider how far the Royal Agricultural Society can co-operate with the local Agricultural Societies in carrying out investigations into subjects of practical utility to Agriculture, they have recently, on the recommendation of that Committee, issued invitations to the Committees of County Agricultural Societies to hold a conference of representatives for the purpose of considering how far it is possible to establish such a system of co-operation.

The Council have resolved to urge upon the Agricultural Department of the Privy Council the necessity of taking steps to organize a system for the investigation of the causes of outbreaks of contagious diseases of animals, and for ascertaining the duration of the vitality of the germs which produce them.

The work of the Seeds and Plants Diseases Committee continues to make steady progress. In the Entomological Section more than 400 letters have been written by the Consulting Entomologist solely with reference to the attacks of Insects upon Farm Crops, besides much other correspondence with public bodies, as well as enquiries from the Colonies with regard to insect injuries to crops of various kinds.

Mr. Carruthers, the Consulting Botanist, has had more than 600 cases submitted to him during the year, chiefly of grass seeds. Some, however, were connected with weeds, diseased crops, and injuries to animals due to poisonous plants. The results of the examination of grass seeds show a remarkable improvement in respect of their germinating power, and freedom from mixture with worthless seeds.

The Scientific advisers of this Committee have been officially consulted by departments of the Home as well as by the Indian and Colonial Governments in regard to matters connected with their respective spheres of work.

Thirty-eight candidates were entered for examination for the Society's Junior Scholarships from six schools, and there was one unattached candidate. The result of the examination is that as many as twenty candidates obtained sufficient marks to qualify them for scholarships. Of these the first ten in the following list, arranged in order of merit, will receive Scholarships upon complying with the Society's regulations, and the remainder will receive certificates of merit:—

Surrey County School	John Horace Reeves.
Unattached	James Muir.
Aspatria School	Robert Smallwood.
Surrey County School	John Percy George Hill.
" " "	Herbert James Reeves.
Aspatria School	Robert Cowen.
Northampton Grammar School ..	Arthur S. Blackwell.
Bedford County School	Stanley Arthur Lane.
Surrey County School	Edward Aug. Wheeley.
Portsmouth Grammar School	Fredk. William Russell.
Bedford County School	Richard Robinson.
Ashburton Grammar School	William Ellis.
Bedford County School	Claude Robinson Lucas.
Surrey County School	John Ramsay Bishop.
Northampton Grammar School ..	Henry Thomas Bradford.
Ashburton Grammar School	Robert Francis Rendell.
Bedford County School	Thomas Henry Richardson.
Surrey County School	Arthur Wynne Hersee.
Aspatria School	Archibald C. C. Martyn.
Surrey County School	George Ernest May.

The Council are glad to see that the candidates for Scholarships were sent up from a greater number of Schools than before, and that from each of these Schools pupils have passed the examination with credit, a fact which appears to point to a wider appreciation of the Society's efforts to encourage Agricultural teaching.

By Order of the Council,

H. M. JENKINS,

Secretary.

Royal Agricultural Society of England.

1886.

DISTRIBUTION OF MEMBERS OF THE SOCIETY AND OF MEMBERS OF COUNCIL.

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
A.	Bedfordshire ..	120 ..	3	Duke of Bedford, K.G., V.P.; C. Howard; James Howard.
	Buckinghamshire	107		
	Cambridgeshire ..	100 ..	2	H. J. Little; J. Martin.
	Essex	223 ..	1	W. Gilbey.
	Hertfordshire ..	149 ..	1	Sir J. B. Lawes, V.P.
	Huntingdonshire ..	47 ..	1	W. Wells, T.
	Middlesex	439 ..	1	G. M. Allender.
	Norfolk	321 ..	3	H.R.H. the Prince of Wales, K.G., T.; Hugh Aylmer; Robert Leeds.
	Oxfordshire ..	150 ..	2	Earl of Jersey; J. Druce.
	Suffolk	202 ..	1	Sir E. C. Kerrison, V.P.
		—1858	— 15	
B.	Cumberland	181 ..	1	S. P. Foster.
	Durham	179 ..	2	Earl of Ravensworth, V.P.; W. T. Scarth.
	Northumberland ..	170 ..	2	Sir M. White Ridley; Jacob Wilson.
	Westmoreland ..	74 ..	1	W. H. Wakefield.
		— 604	— 6	
C.	Derbyshire	207 ..	2	Hon. E. K. Coke; H. Chandos-Pole-Gell.
	Leicestershire ..	95 ..	1	Duke of Rutland, T.
	Lincolnshire	270 ..	3	Sir J. H. Thorold; H. Chaplin; W. Frankish.
	Northamptonshire	129 ..	1	Earl Spencer, V.P.
	Nottinghamshire ..	195 ..	1	J. Hemsley.
	Rutland	14 ..		
		— 910	— 8	

DISTRIBUTION OF MEMBERS OF THE SOCIETY—*continued.*

Districts.	Counties.	Number of Members.	Number in Council.	Members of Council.
D.	Berkshire	165 ..	1	M. J. Sutton.
	Cornwall	68		
	Devonshire	118 ..	2	Sir T. D. Acland, T.; Sir M. Lopes, V.P.
	Dorsetshire	77 ..	1	Viscount Portman, T.
	Hampshire	198 ..	3	Viscount Eversley, V.P.; Sir A. K. Macdonald, T.; J. A. Caird.
	Kent	425 ..	3	R. Russell; C. Whitehead; C. de Laune.
	Somersetshire ..	171 ..	2	Visct. Bridport, T.; R. Neville.
	Surrey	197 ..	1	G. H. Sanday.
	Sussex	251 ..	3	Duke of Richmond and Gordon, V.P.; H. Gorringe; R. A. Warren.
	Wiltshire	125 ..	1	J. Rawlence.
		——1795	— 17	
E.	Yorkshire	667 ..	4	Earl Cathcart, V.P.; Earl of Feversham; C. Clay; J. D. Dent, T.
F.	Gloucestershire ..	216 ..	2	Lord Moreton; Col. Kingscote, T.
	Herefordshire ..	148 ..	1	J. H. Arkwright.
	Monmouthshire ..	35 ..	1	R. Stratton.
	Shropshire	543 ..	3	A. P. Lloyd; J. Bowen-Jones; W. Sheraton.
	Staffordshire ..	270 ..	2	Earl of Lichfield, T.; Marquis of Stafford.
	Warwickshire ..	214 ..	1	P. A. Muntz.
	Worcestershire ..	191 ..	2	Earl of Coventry; C. Randell.
	South Wales ..	173 ..	2	Viscount Emlyn; Sir H. Hussey Vivian.
		——1790	— 14	
G.	Cheshire	284 ..	3	Lord Egerton, T.; Hon. Cecil T. Parker; A. Ashworth.
	Lancashire	469 ..	3	Duke of Devonshire, V.P.; Earl of Lathom, V.P.; T. H. Miller.
	North Wales ..	238 ..	2	Earl of Powis, T.; C. S. Mainwaring.
	——	—— 991	— 8	
Scotland		140		
Ireland		120		
Channel Islands		15		
Foreign Countries		114		
Honorary Members		19		
Members without addresses ..		131		
		—— 539		

ROYAL AGRICULTURAL

Dr. **HALF-YEARLY CASH ACCOUNT**

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st July, 1885:—			
Bankers	3,473 12 7		
Secretary	8 1 11		
		3,481 14 6	
At Deposit		2,000 0 0	
			5,481 14
To Income:—			
Dividends on Stock		433 6 8	
Interest on Deposit		28 14 9	
Subscriptions:—			
Governors' Annual	10 0 0		
Members' Life-Compositions	348 0 0		
Members' Annual	982 1 0		
		1 340 1 0	
Establishment		11 5 0	
Journal:—			
Sales	76 15 1		
Sale of Pamphlets	14 15 10		
Advertisements	164 8 7		
		255 19 6	
Chemical:—			
Laboratory Fees		230 16 9	
Education:—			
Sale of Insect Diagrams		3 13 3	
Farm Prize Competition:—			
Prizes given by Preston Local Committee	305 0 0		
Entry Fees for 1886	22 0 0		
		327 0 0	
Sundries:—			
Silo Entry Fees		56 0 0	
Shrewsbury Meeting		70 1 9	
Total Income			2,756 18 8
To Preston Meeting			17,124 4 6
			£25,362 17 8

BALANCE-SHEET,

LIABILITIES.	£ s. d.	£ s. d.	£ s. d.
To Capital:—			
Surplus, 30th June, 1885		37,720 2 11	
Less Surplus of Expenditure over Income during the Half-year, viz.:—			
Expenditure	5,235 0 10		
Income	2,756 18 8		
		2,478 2 2	
			35,242 0 9
Deduct half-year's interest and depreciation on Country Meeting Plant			248 1 7
			34,993 19 2
To Preston Meeting:—			
Excess of Receipts over Expenditure			2,733 11 6
			£37,727 10 8

QUILTER, BALL, CROSBIE, GLEGG & WELTON, *Accountants.*

SOCIETY OF ENGLAND.

FROM 1ST JULY TO 31ST DECEMBER, 1885. Cr.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	875 0 0		
House:—Rent, Taxes, Repairs, &c.	502 18 0		
Office:—Printing, Postage, Stationery, &c.	299 17 3		
		1,677 15 3	
Journal:—			
Printing and Stitching Journal	687 19 6		
" " Index	276 8 0		
Printing Advertisements..	60 12 6		
Postage and Delivery	290 0 0		
Literary Contributions	247 16 6		
Woodcuts and Electros	26 7 0		
Advertising..	32 19 8		
		1,622 3 2	
Chemical:—			
Salaries	300 0 0		
Apparatus and Chemicals	28 9 4		
Printing, Advertising and Stationery	38 7 6		
Petty Payments	10 0 0		
		376 16 10	
Veterinary		2 5 0	
Seeds and Plants Diseases:—			
Consulting Entomologist's Salary	50 0 0		
Consulting Botanist's Salary	50 0 0		
		100 0 0	
Education:—			
Printing and Advertising	30 17 6		
Scholarships	200 0 0		
		230 17 6	
Farm Prize Competition:—			
Prizes	395 0 0		
Judges	469 1 9		
Advertising	74 8 3		
Entry Fee returned	2 0 0		
		940 10 0	
Sundries, Silo Competition:—			
Advertising	32 6 4		
Judges (on account)	252 6 9		
		284 13 1	
Total Expenditure..			5,235 0 10
By Country Meeting Plant			63 19 0
By Stock:—Purchase of £2010 1s. 3d. Consols			2,000 0 0
By Preston Meeting			16,025 15 2
By Norwich Meeting			481 6 8
			23,806 1 8
By Balance in hand, 31st December:—			
Bankers		1,503 6 10	
Secretary..		53 9 2	
			1,556 16 0
			£25,362 17 8

31ST DECEMBER, 1885.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	1,556 16 0	
By New 3 per Cent. Stock 29,885*l*. 4*s*. 4*d*. cost*	29,177 17 1	
By Consols 2,010*l*. 1*s*. 3*d*. cost†	2,000 0 0	
By Books and Furniture in Society's House	1,451 17 6	
By Country Meeting Plant	3,059 13 5	
		37,246 4 0
At Debit of Norwich Meeting		481 6 8
		£37,727 10 8

* *Value at* 99½ = 29,735*l*. 15*s*. 10*d*.
† *Value at* 99⅜ = 1,997*l*. 10*s*. 0*d*.

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscriptions to 31st December, 1885, which at that date amounted to 1,156*l*.

Examined, audited, and found correct, this 22nd day of March, 1886.

FRANCIS SHERBORN,
A. H. JOHNSON,
C. GAY ROBERTS,
} *Auditors on behalf of the Society.*

ROYAL AGRICULTURAL

DR. YEARLY CASH ACCOUNT,

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st Jan. 1885:—			
Bankers	. .	708 2 5	
Secretary	. .	63 4 1	
			771 6 6
To Income:—			
Dividends on Stock	. .	868 10 9	
Interest on Deposit Account	. .	28 14 9	
Subscriptions:—			
Governors' Life Composition	50 0 0		
Governors' Annual	270 0 0		
Members' Life-Compositions	1,315 0 0		
Members' Annual	5,192 7 0		
		6,827 7 0	
Establishment:—			
Rent, &c.	. .	221 5 0	
Journal:—			
Sales	145 11 9		
Advertisements	314 6 10		
Sale of Pamphlets	37 13 3		
Prize offered by Col. Turbervill	25 0 0		
		522 11 10	
Chemical:—			
Laboratory Fees	. .	419 18 0	
Education:—			
Sale of Insect Diagrams	. .	11 9 3	
Farm Prize Competition:—			
Prizes given by the Preston Local Committee	305 0 0		
Entry Fees for 1886	22 0 0		
		327 0 0	
Sundries:—			
Silo Entry Fees	. .	56 0 0	
Shrewsbury Meeting	. .	338 7 4	
Preston Meeting	. .	24,415 9 3	
Total Income	. .	. .	34,036 13 2
			£34,807 19 8

SOCIETY OF ENGLAND.

FROM 1ST JANUARY TO 31ST DECEMBER, 1885. CR.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	1,777 10 0		
House: Rent, Taxes, &c.	899 1 8		
Office: Printing, Postage, Stationery, &c.	522 2 8		
		3,193 14 4	
Journal:—			
Printing and Stitching Journal	1,367 3 3		
" " " Index	276 8 0		
Printing Advertisements	128 11 0		
Postage and Delivery	540 0 0		
Advertising	32 19 8		
Literary Contributions	396 2 6		
Prize Essay	25 0 0		
Wood Engravings and Electros	66 0 0		
		2,832 4 5	
Chemical:—			
Salaries	577 17 8		
Apparatus and Chemicals	46 9 10		
Printing, Advertising, and Stationery	45 19 3		
Petty Payments	29 14 0		
		700 0 9	
Veterinary:—			
Medals	2 5 0		
Professional Fees	23 1 2		
		25 6 2	
Seeds and Plants Diseases:—			
Consulting Entomologist's Salary	75 0 0		
Consulting Botanist's Salary	100 0 0		
		175 0 0	
Education:—			
Fees to Examiners	36 15 0		
Printing and Advertising	53 10 3		
Scholarships	200 0 0		
Prizes	50 0 0		
		340 5 3	
Farm Prize Competition:—			
Prizes	395 0 0		
Judges	537 5 4		
Advertising	74 8 3		
Entry Fees returned	3 0 0		
		1,009 13 7	
Sundries:—			
Advertising Silo Competition	32 6 4		
Judges on account ditto	252 6 9		
Miscellaneous	24 14 2		
		309 7 3	
Subscriptions (paid in error) returned	. .	7 2 0	
Shrewsbury Meeting	. .	94 12 2	
Preston Meeting	. .	20,449 2 10	
Norwich Meeting	. .	481 6 8	
Total Expenditure	. .	. .	29,622 15 5
Country Meeting Plant	. .	. .	1,628 8 3
Stock:—			
Purchase of £2010 1*s.* 3*d.* Consols	. .	. .	2,000 0 0
Balance in hand, 31st Dec. 1885:—			
Bankers	. .	1,503 6 10	
Secretary	. .	53 9 2	
			1,556 16 0
			£34,807 19 8

Receipts.

	£	s.	d.
Subscription from Preston	2,000	0	0
Admissions to Show Yard by Payment	8,564	18	3
Admissions by Season Tickets	476	5	6
Admissions to Stand at Horse Ring	550	19	6
Admissions to Dairy	25	2	9
Sale of Catalogues	740	3	6
Sale of Guides to Dairy	6	1	7
Entries in Implement Catalogue	370	0	0
Advertisements in Stock Catalogue	227	4	6
Implement Exhibitors' Payment for Shedding	4,013	4	3
Non-Members' Fees for Entry of Implements	201	0	0
Fees for Entry of Live-Stock, &c.	662	10	0
Fees for Horse Boxes and Stalls	301	0	0
Fees for Entry of Poultry	74	2	6
Premium for Supply of Refreshments	375	0	0
Premium for Cloak Rooms, Lavatories, &c.	60	0	0
Fines for Non-Exhibition of Live-Stock	150	0	0
Fines, &c., for Implements	17	0	0
Sales of Butter and Milk	31	10	10
Sales of Fodder	82	5	2
	£18,928	8	4

EXPENDITURE.

	£ s. d.	£ s. d.
SHOW YARD WORKS:—		
By Timber and Joinery	4,591 0 5	
,, Ironmongery, 118*l.* 7*s.* 8*d.*; Hurdles, 122*l.* 17*s.* 0*d.*	241 4 8	
,, Bricks, Lime and Cement	15 0 4	
,, Paints, Oils, Glass, &c.	45 10 10	
,, Canvas, Felt, Baize, &c.	1,383 18 0	
,, Railway Charges, 274*l.* 12*s.* 4*d.*; Horse Hire, 281*l.* 7*s.* 10*d.*	556 0 2	
,, Coals, 23*l.* 1*s.* 9*d.*; Insurance, 10*l.* 10*s.*	33 11 9	
,, Postage and Stationery	32 7 2	
,, Sundries	26 16 8	
,, Wages	1,841 0 11	
,, Superintendent of Works—Salary and Expenses	576 9 5	
,, Depreciation of Plant	511 1 9	
		9,854 2 1
Per Contra:—		
By Sale of Materials	3,045 9 6	
,, Work for Exhibitors and Purveyors	1,425 9 1	
		4,470 18 7
		5,383 3 6
Judges' Fees.—Implements, 60*l.* 10*s.*; Stock, 460*l.* 11*s.* 7*d.*; Poultry, 22*l.* 15*s.* 10*d.*; Cheese and Butter-Workers, and Cheese and Butter, 55*l.* 17*s.* 9*d.*		599 15 2
Inspectors' Fees.—Veterinary, 80*l.* 10*s.*; Shearing, 22*l.* 4*s.* 6*d.*; Veterinary Assistants, 26*l.* 10*s.*		129 4 6
Police.—Metropolitan		589 16 6
Clerks and Assistants:—Bankers', 32*l.*; Secretary's and Stewards', 121*l.* 16*s.* 6*d.*		153 16 6
Foremen and Assistant-Foremen		100 2 10
Yardmen, Grooms, Foddermen, 313*l.* 14*s.* 7*d.*; Mowing Yard, 13*l.* 8*s.* 5*d.*		327 3 0
Superintendent of Turnstiles, Money Changer, and Money Takers, 81*l.* 13*s.*; Doorkeepers, 59*l.* 4*s.*		140 17 0
Stewards' Hotel Expenses, &c., 256*l.* 14*s.* 3*d.*; Assistant-Stewards, 78*l.* 15*s.* 2*d.*		335 9 5
Lodgings for Assistant Stewards, Implement Judges, and other Officials		133 19 0
Refreshments and Allowances		160 6 10
Preston Bankers' Charges		17 2 11
Catalogues.—Implements, 369*l.* 18*s.* 1*d.*; Stock, 333*l.* 17*s.*; Poultry, 6*l.* 10*s.*; Awards, 55*l.* 13*s.*; Plan of Yard, 31*l.*; Guide to Dairy, 11*l.* 2*s.*; New Packing Cases, Carriage, &c., 44*l.* 6*s.*; Commission, &c., 54*l.* 4*s.*		906 10 1
Printing, 998*l.* 16*s.* 11*d.*; Advertising and Bill Posting, 1,009*l.* 11*s.* 11*d.*		2,008 8 10
Postage, Stationery, Telegrams, Carriage, &c.		197 2 1
Engineering.—Engineers, 159*l.* 15*s.* 8*d.*; Assistants and Labourers, 39*l.* 4*s.* 3*d.*; Insurance of Machinery, 7*l.* 9*s.* 3*d.*; Ironmongery and Sundries, 24*l.* 15*s.* 6*d.*		231 5 1
Dairy:—Milk, 115*l.* 13*s.* 8*d.*; Ice, 9*l.* 4*s.* 9*d.*; Rennet, 15*s.* 6*d.*; Dairymaids, 30*l.*; Clerk, 9*l.* 9*s.*; Use of Utensils, 15*l.* 7*s.* 5*d.*, and Carriage, 6*l.* 9*s.*; Cheese Vats, 9*l.* 6*s.*; Thermometer, 1*l.* 18*s.* 6*d.*; Sundries, 1*l.* 0*s.* 5*d.*		199 4 3
Hay, 232*l.* 5*s.*; Straw, 398*l.* 7*s.* 1*d.*; Green Food, 261*l.* 6*s.*; Stacking Hay and Straw, 35*l.* 8*s.* 9*d.*; Insurance and other Expenses, 7*l.* 5*s.*		934 11 10
Land for Trials, 12*l.* 12*s.*; Fire Engines, 37*l.* 5*s.* 11*d.*		49 17 11
Horse and Carriage Hire, 84*l.* 11*s.* 9*d.*; Carriage, 16*l.* 2*s.* 9*d.*		100 14 6
Journeys previous to Show, 26*l.* 18*s.*; Secretary and Official Staff, 42*l.* 10*s.* 3*d.*		69 8 3
Hire of Furniture, 64*l.* 2*s.* 7*d.*; Hire of Plants, 11*l.* 15*s.*; Hire of Chairs, 18*l.* 17*s.* 2*d.*		94 14 9
Expenses of Analysis of Milk of Dairy Cows		10 0 6
Poultry:—Hire of Bottles, 7*l.* 10*s.*; Chaff, Carriage and Gratuities, 7*l.* 8*s.* 10*d.*		14 18 10
Jackets and Caps, &c., 17*l.* 15*s.* 5*d.*; Hats for Boys, 4*l.* 15*s.*		22 10 5
Commissionaires, 14*l.* 16*s.* 8*d.*; Boy Messengers, 10*l.* 16*s.*		25 12 8
Veterinary Medicines, 2*l.* 6*s.* 9*d.*; Hire of Harmonium, 1*l.* 1*s.*; Ironmongery, 10*l.* 1*s.* 5*d.*; Twine, 1*l.* 2*s.* 11*d.*; Telegraph Extension, 12*l.* 16*s.* 8*d.*; Tan, 5*l.* 8*s.*; Calico, 6*l.* 14*s.* 10*d.*; Corn, 4*l.* 12*s.* 7*d.*		44 4 2
Soap, Repairing Flags, Towels, Combs, Crockeryware and Cutlery, and Sundries		14 11 8
Bee Exhibition		30 0 0
Rosettes, 25*l.* 6*s.* 4*d.*; Medals, 7*l.* 4*s.*		32 10 4
Prizes: Stock, 3,573*l.**; Cheese and Butter, 75*l.*;† Cheese and Butter Workers, 10*l.*; Implements, 12*l.*; Poultry, 280*l.*		3,950 0 0
		£17,007 3 4
By Balance		1,921 5 0
		£18,928 8 4

* Exclusive of 780*l.* given by the Preston Local Committee; 100*l.* by the Corporation of Blackpool; 50*l.* by the Shorthorn Society; 30*l.* by the Hereford Herd Book Society; and 25*l.* by the Shire Horse Society.

† Exclusive of 87*l.* given by the Preston Local Committee.

AGRICULTURAL EDUCATION.

ELEMENTARY EXAMINATION of Pupils of Middle-Class and other Schools.

Examination Papers, 1886.

A. AGRICULTURE.

November 10th, 1885. *Three Hours Allowed.*

Your place will be determined more by the quality than the quantity of your work.

I.—THE SOIL.

is (1) a warehouse of the food of plants—(2) a laboratory in which the food of plants is prepared—(3) a machine by which the food of plants is administered.

1. *As a warehouse*—(*a*) On what ingredients in it does the fertility of a soil principally depend?—(*b*) By what operations on the farm is the store of these ingredients kept replenished?—(*c*) Is there any other store-room of plant food, and what does it supply?

2. *As a laboratory*—(*a*) On what processes in it does the fertility of a soil depend?—(*b*) What new chemicals are annually or occasionally added to it in the operations of the farm?—(*c*) What processes are these susbtances likely, severally, to quicken or set going, or, possibly, to check?

3. *As a machine*—(*a*) What are the mechanical characteristics of a soil on which its ability to administer plant food depends?—(*b*) What annual or occasional operations are conducted on the soil in order to maintain or improve its capability as a machine for feeding plants?—(*c*) What improvements in the mechanical ability or character of a soil are these operations, severally, likely to effect?

II.—THE CROPS.

are (1) sown in properly prepared ground—(2) cultivated during their growth—(3) harvested either for use upon the farm or for despatch to market.

1. *As to seed-time*—(*a*) What are the conditions of successful germination required by all seeds?—(*b*) What are the special circumstances of any field, whether as to character of soil, or present

condition, or past history, which would mark it out as fit for wheat or turnips for next year's crop?

2. *As to cultivation*—(*a*) What things are essential in the condition of land in order to the success of any crop on it?—(*b*) Describe the cultivation of the turnip crop from seed-time till harvest-time.—(*c*) What are the risks of failure which the turnip crop incurs during growth; and what is the best way of meeting them?

3. *As to harvest*—(*a*) At what stage of ripeness should wheat, barley, oats, respectively, be cut?—(*b*) What is a silo, and how do you manage in order to the production of sweet silage or of sour?

III.—THE LIVE STOCK OF THE FARM.

1. Enumerate them—naming all the breeds of each kind, and adding a few words descriptive of each breed.

2. What are the principal ingredients in food as determined by chemical analysis?

3. What becomes of these several ingredients of any food when given—say to a cow in-milk?

4. Describe the process of cheese-making.

NOTE BY THE EXAMINER.

Write only on one side of your sheet—Don't waste time in introductory remarks—Don't repeat the questions—Answer them in the fewest possible words—A few questions thoroughly answered will have more weight than any proof you can give of imperfect knowledge of many.

B. MECHANICS AND NATURAL PHILOSOPHY.

November 11*th*, 1885. *Three Hours Allowed.*

1. Define stable and unstable equilibrium.

A rectangular solid (*e.g.* a packing case) is placed on a horizontal plane: mention one position in which its equilibrium would be stable, and one in which its equilibrium would be unstable. In what position would its equilibrium be most stable?

2. A force of 100 units acts along a line making an angle of 30° with the vertical; find its horizontal and vertical components by construction or otherwise.

3. Define the moment of a force with reference to a given point.

A rod of uniform density weighing 20 lbs. can turn freely round a hinge at one end; the other end rests against a smooth vertical wall; the rod is inclined at an angle of 45° to the horizon; find the pressure on the wall.

4. Describe briefly the wheel and axle, and find the relation between the power and the weight, when they keep it in equilibrium.

If the radius of the axle is 5 in. and that of the wheel $2\frac{1}{2}$ ft., what power will be required to balance a weight of 840 lbs.? If the wheel and axle and the ropes weigh 300 lbs., what will be the whole pressure on the bearings that support the machine?

5. A body is observed to increase its velocity in every second by 5 ft. a second; how far would it move from a state of rest in 12 seconds? If the mass of the body is 15 lbs. what is the numerical value of the force which produces the motion? How many pounds of matter would that force support against gravity at a place where $g = 32°$.

6. State one method of determining the specific gravity of a liquid.

Two gallons of a liquid whose specific gravity is 0·9, are mixed with three gallons of a liquid whose specific gravity is 0·8; assuming that the mixture takes place without expansion or contraction, find the specific gravity of the mixture.

7. Mention briefly the reasons for believing air to be a heavy elastic fluid.

A bladder partly filled with air and tied tightly, so that none of the air can get out, is put under the receiver of an air pump; it is well known that if the air is partly withdrawn from the receiver the bladder swells out; what property of air does this demonstrate?

8. Describe briefly the mercurial barometer in its simplest form.

A barometer, whose tube is 32 in. long above the surface of the mercury in the cistern, is found to read 27 in. when the true reading is 29 in.; what may it be expected to read when the true reading is 30 in.? In what way would the reading of the faulty barometer be affected by change of temperature?

9. Describe briefly one method, commonly used, for converting the up-and-down motion of the piston of a steam-engine into the continuous rotation of the axle which carries the fly-wheel.

10. The area of the piston of a steam-engine is 5000 square in., and the stroke is 8 ft. long; the mean pressure of the steam is 12 lbs. per square inch; how many strokes are made per minute when the machine works with 160 horse-power?

C. ELEMENTARY CHEMISTRY.

November 10*th*, 1885. *Three Hours Allowed.*

1. What is ozone? How can it be obtained and how distinguished?

2. Prove synthetically the composition of pure water by weight?

3. Define the terms :—atom ; molecule ; quantivalence ; element.

4. In what distinct form does carbon occur? What is the result of burning carbon (*a*) in a limited supply of oxygen (*b*) in an excess of oxygen? How can one product be converted into the other, and *vice versâ?*

5. What compounds does sodium form with two following bodies :—sulphuric acid, hydrochloric acid, nitric acid, phosphoric acid, carbonic acid, arsenious acid? Give the formulæ, with the common names by which any of the compounds are known.

6. How would you show whether atmospheric air was a mixture of gases or a compound?

7. What are the ordinary constituents of coal gas after purification? What are the chief impurities, and what other important bodies are formed in the manufacture of coal gas?

8. What takes place when hydrogen and chlorine gases are mixed? What when powdered antimony is thrown into a jar containing chlorine? What when a piece of litmus paper is thrown in?

9. What is glass composed of? Name any varieties. How is coloured glass obtained?

10. How is caustic potash obtained? How would you distinguish between caustic potash, caustic soda, and carbonate of soda?

11. Name the principal oxides of iron. How would you distinguish ferrous and ferric salts?

12. Give chemical names and formulæ for the following :—heavy spar; pearl-ash; nitre; Epsom salts; sugar of lead; litharge: cinnabar.

D. MENSURATION AND LAND SURVEYING.

November 11*th*, 1885. *Two Hours Allowed.*

1. Draw, to a scale of 100 ft. to an inch, a triangle whose sides are 325 ft., 466 ft., and 220 ft.; and note the number of degrees in each angle.

From the greatest angle let fall a perpendicular to the longest side and note its length in feet.

2. A rectangular piece of ground is one square mile in area; one side of it is 73 chains long; what is the length of one of the adjacent sides?

3. A carriage wheel makes 336 turns when the carriage is drawn a distance of 1 mile; what is the radius of the wheel? If a carriage wheel has fourteen spokes, how many degrees, minutes, &c., would there be in the angle between two consecutive spokes, if the spokes are treated as lines?

4. The length and breadth of a house at the eaves are 45 ft. and 32 ft. respectively; the annual rainfall in the neighbourhood of the house is 28 in.; a rectangular reservoir has to be made to hold a quarter of the rain that falls yearly on the house; if its length and breadth are 20 ft. and 8 ft., what must its depth be?

5. A B C D is a four-sided field; the distance from A to C is 10 chains; the field book gives the numbers entered in the margin of the question; plot the field to a scale of 2 chains to the inch, and find its area.

6. A plan is given you without a scale, but you know that two points shown on it are 2250 yards apart; the measured distance between them on the plan is 21 in.; draw a plain scale of 1000 ft. for the plan and divide it in such a way that all distances (being multiples of 10 ft.) up to 1000 ft. can be measured by means of it.

	680	0 A
0	470	0
80	300	
	140	0
D	000	0
C	400	D
	600	C
10	300	
	200	0
B	000	0
	700	B
	580	40
	300	0
	200	50
A	000	0

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W. Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, May 22nd, 1886, at 12 o'clock.

MEETING at Norwich, July 12th to 16th, 1886.

GENERAL MEETING in London, December, 1886.

MONTHLY COUNCIL (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays, 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on page xxix in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page xxvi).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (page xxxi).

SUBSCRIPTIONS.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker's or any other house of business in London will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the postmaster the correct initials and surname of the Secretary of the Society (H. M. Jenkins), otherwise the payment will be refused to him at the post-office on which such order has been obtained; and when remitting the money-orders it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be drawn on a London (not on a local country) banker. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper party. No coin can be remitted by post, unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary.

*** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

THE Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *boná-fide* and sole use of Members of the Society; who, to avoid all unnecessary correspondence, are particularly requested, when applying to him, to mention the kind of analysis they require, and to quote its number in the subjoined schedule. Governors of the Society are also allowed to send to the Society's Laboratory for analysis, at the following scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants. The charge for analysis, together with the cost of the carriage of the specimens (if any), must be paid to the Consulting Chemist at the time of application:

No.

1.—An opinion of the genuineness of bone-dust or oil-cake (each sample) 2*s.* 6*d.*

2.—An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda .. .. 5*s.*

3.—An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it .. .. 10*s.*

4.—An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be sent with it .. .. 5*s.*

5.—An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it .. 10*s.*

6.—An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it .. .. 10*s.*

7.—An analysis of limestone, showing the proportion of lime .. .. 7*s.* 6*d.*

8.—An analysis of limestone, showing the proportion of lime and magnesia 10*s.*

9.—An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay 10*s.*

10.—Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime .. .. 10*s.*

11.—Complete analysis of a soil £3

12.—An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties .. .. 10*s.*

13.—Analysis of any vegetable product .. .. 10*s.*

14.—Analysis of animal products, refuse substances used for manures, &c. from 10*s.* to £1

15.—Determination of the "hardness" of a sample of water before and after boiling .. .. 5*s.*

16.—Analysis of water of land-drainage, and of water used for irrigation £1

17.—Analysis of water used for domestic purposes .. .. £1 10*s.*

18.—Determination of nitric acid in a sample of water .. .. .. 10*s.*

19.—Examination of Viscera for Metallic poison .. .. £2 2*s.*

20.—Examination of Viscera complete, for metals and alkaloids .. .. £5 5*s.*

21.—Personal consultation with the Consulting Chemist. The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment, it is suggested that Members desiring to hold a consultation with the Consulting Chemist should write to make an appointment) .. .. 5*s.*

22.—Consultation by letter .. .. 5*s.*

23.—Consultation necessitating the writing of three or more letters .. 10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, requests that all letters and parcels (postage and carriage paid) from Members of the Society, who are entitled to avail themselves of the foregoing Privileges, should be directed.

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

Feeding Cakes.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.
2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.
3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.
4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

Artificial Manures.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain not less than 45 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.
2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain not less than 48 per cent. of tribasic phosphate of lime, and to yield not less than 1¾ per cent. of ammonia.
3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed, under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.
4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.
5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.
6. *Nitrate of Soda* should be guaranteed by the vendor to contain from 94 to 95 per cent. of pure nitrate.
7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 23 per cent. of ammonia.
8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12, HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples not exceeding 12 oz., for four postage stamps.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12, HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials. No parcel sent by post must exceed 12 oz. in weight, 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcels post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid..

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory, specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any Member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a visiting Inspector will be 2*l.* 2*s.* each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in cases of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the results of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector	10*s.* 6*d.*
Consultation by letter	10*s.* 6*d.*
Post-mortem examination, and report thereon	21*s.*

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs, 3*s.* 6*d.* per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan	Not yet appointed.
Carmarthen	ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester..	W. Lewis, 1, South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.

County.	*Name and Address.*
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset	W. Vessey, Weymouth.
Durham	H. Peele, Tower Street, West Hartlepool.
Essex	James Taylor, Vengewell Hall, Wix Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Professor Garside, Royal Agricultural College, Cirencester.
Hants	J. D. Barford, 57, Above Bar, Southampton.
Hereford	W. Good, 30, Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	W. Bromley, Lancaster.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)	Charles Hartley, 4, Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1, Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	Calver and Smith, Downham Market.
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmoreland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	C. Gresswell, Albert Square, Derby Road, Nottingham.
Oxford	Chas. N. Page, Banbury.
Pembroke	D. E. James, Bridge House, Haverfordwest.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	A. J. Shorten, 14, Museum Street, Ipswich.
Surrey	J. I. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	J. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28, Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz.:—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical and Entomological Privileges.

The Council have fixed the following rates of charge for the examination of Plants, Seeds, and Insects for the *bonâ fide* and individual use and information of Members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, or to the Consulting Entomologist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

I. BOTANICAL.

No.		
1.—	A report on the purity, amount, and nature of foreign materials, the perfectness, and germinating power of a sample of seed ..	5*s.*
2.—	Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention	5*s.*
3.—	Report on any disease affecting farm crops	5*s.*
4.—	Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value	10*s.*

N.B.—The Consulting Botanist's Reports are furnished to enable Members,—purchasers of seeds and corn for agricultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser. If anything supposed to be injurious or useless exists in the corn or seed, selected samples should also be sent.

When possible, at least one ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which the seed has been bought (but preferably a copy of the invoice) should accompany the sample.

Grass seeds should be sent at least four weeks, and clover seeds two weeks before they are to be used.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry.

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S., Central House, Central Hill, Norwood, S.E.

It is necessary that before the purchaser of seeds send the sample for examination he secure—

1. That the vendor specify the nature of the article supplied.
2. That the bulk be true to the bulk specified.
3. That it contain not more than 5 per cent. of seeds other than the species ordered.
4. That the germinating power shall be, for cereals, green crops, clovers, and timothy grass, not less than 90 per cent.; for fox-tail, not less than 50 per cent.; and for other grasses not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

II. ENTOMOLOGICAL.

Determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm crops, with a report on its habits and suggestions as to its extermination .. .. 2*s.* 6*d.*

Parcels or letters containing insects, or plants apparently infested with insects, sent for examination, must be addressed to Miss ORMEROD, F.R.Met.Soc. Dunster Lodge, Spring Grove, Isleworth.

THE

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY

OF ENGLAND.

SECOND SERIES.

VOLUME THE TWENTY-SECOND.

PRACTICE WITH SCIENCE.

LONDON:
JOHN MURRAY, ALBEMARLE STREET.
1886.

THESE EXPERIMENTS, IT IS TRUE, ARE NOT EASY; STILL THEY ARE IN THE POWER OF EVERY THINKING HUSBANDMAN. HE WHO ACCOMPLISHES BUT ONE, OF HOWEVER LIMITED APPLICATION, AND TAKES CARE TO REPORT IT FAITHFULLY, ADVANCES THE SCIENCE, AND, CONSEQUENTLY, THE PRACTICE OF AGRICULTURE, AND ACQUIRES THEREBY A RIGHT TO THE GRATITUDE OF HIS FELLOWS, AND OF THOSE WHO COME AFTER. TO MAKE MANY SUCH IS BEYOND THE POWER OF MOST INDIVIDUALS, AND CANNOT BE EXPECTED. THE FIRST CARE OF ALL SOCIETIES FORMED FOR THE IMPROVEMENT OF OUR SCIENCE SHOULD BE TO PREPARE THE FORMS OF SUCH EXPERIMENTS, AND TO DISTRIBUTE THE EXECUTION OF THESE AMONG THEIR MEMBERS.

VON THAER, *Principles of Agriculture.*

LONDON: PRINTED BY WILLIAM CLOWES AND SONS, LIMITED, STAMFORD STREET
AND CHARING CROSS.

CONTENTS OF VOLUME XXII.

SECOND SERIES.

APPENDIX.

DIRECTIONS TO THE BINDER.

The Binder is desired to collect together all the Appendix matter, with Roman numeral folios, and place it at the *end* of each volume of the Journal, excepting Titles and Contents, and Statistics &c., which are in all cases to be placed at the *beginning* of the Volume; the lettering at the back to include a statement of the *year* as well as the *volume*; the first volume belonging to 1839-40, the second to 1841, the third to 1842, the fourth to 1843, and so on.

In Reprints of the Journal all Appendix matter and, in one instance, an Article in the body of the Journal (which at the time had become obsolete), were omitted; the Roman numeral folios, however (for convenience of reference), were reprinted without alteration in the Appendix matter retained.

ERRATA.

In the paper in the last volume of the 'Journal' (Vol. XXI. s.s., Part 2, 1885) —"On the Valuation of Unexhausted Manures," by Sir J. B. Lawes and Dr. Gilbert—the following corrections should be made:—

Table II. p. 601, No. 5, "Undecorticated Cotton-cake":—
Last column but one—*instead of* 5s. 11d., *read* 9s. 3d.
Last column—*instead of* £3 5s. 4d., *read* £3 8s. 8d.

Table III. p. 606, No. 5, "Undecorticated Cotton-cake":—

Instead of—

£ s. d.	£ s. d.	£ s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	£ s. d.
3 5 4	1 12 8	1 1 10	14 6	9 8	6 6	4 4	2 10	1 11	4 14 3

Read—

3 8 8	1 14 4	1 2 11	15 3	10 2	6 10	4 6	3 0	2 0	4 19 0

Page 641, to the signatures of the Judges of Thoroughbreds and Hunters, *add* "COVENTRY."

Page 644, line 50, *for* "I consider the prize-winner," *read* "I consider the prize-winners."

Page 742, lines 11–13, the young man who slipped on one of the barriers, is stated to have recovered from his injuries, and did not die in the Preston Royal Infirmary, as reported.

A mistake which needs correction was made on p. 149 of the present volume of the 'Journal,' where Mr. Hothersall's farm engine is said to have been manufactured by Messrs. Barford and Perkins, of Peterborough. The engine in question was made by Messrs. W. N. Nicholson and Son, of Newark-on-Trent. The mill which, among other machines, is driven by this engine, had been made by Messrs. Barford and Perkins, and the name of the wrong firm was thus entered in the note-book at the time as manufacturers also of the steam-engine. Mr. Hothersall, to whom the First Prize in his Class in the Dairy and Stock Farm Competition at Preston was awarded, writes to express his entire satisfaction with Mr. Nicholson's engine, which had been worked three years continuously without costing anything for repair.

JOURNAL

OF THE

ROYAL AGRICULTURAL SOCIETY OF ENGLAND.

XIV.—*The Lung Parasites of Cattle and Sheep, with Report on Experiments.* By the late T. SPENCER COBBOLD, M.D., F.R.S., Foreign Member of the Royal Agricultural Academy of Turin.

VARIOUS kinds of entozoa infest the lungs of our domesticated herbivora. All of them are more or less injurious to their hosts. The most destructive species belong to the so-called round-worm group of parasites. These entozoa give rise to pulmonary disorders, known by the names of husk or hoose, parasitic bronchitis, verminous pneumonia, lung-worm disease, and so forth. The irritation set up by the parasites in severe cases produces inflammation, leading to obstruction of the smaller air-passages, to plugging of the air-vesicles, and to consolidation of the lung-tissues, ending in complete pulmonary collapse. In the production of this diseased state, one or other of at least five distinct species of thread-like worm is concerned. In some instances more than one species of lung-worm afflict the same animal. The five species of entozoa are thus named:—

1. *Strongylus micrurus;* the small-tailed strongyle, better known as the common cattle lung-worm, or husk-producing worm.
2. *Strongylus filaria;* the large-tailed strongyle, better known as the "Filaria," or common lung-worm of sheep and lambs.
3. *Strongylus paradoxus;* the puzzling strongyle, better known as the lung-worm of the pig.
4. *Strongylus rufescens;* the rufous or reddish-brown strongyle, sometimes called the large lung-worm.
5. *Pseudalius pulmonalis;* the filament lung-worm, better known in England as Dr. Crisp's gordian worm.

Although helminthologists are more or less well acquainted with all these five parasites in their full-grown state, not one of the worms has been followed throughout the various stages of its life. In other words, the present state of our knowledge of the natural history of each species is incomplete. As an aid to further investigation, it is now proposed to supply a brief diagnosis or statement of the characters that distinguish each of the above-named species, followed by a detailed account of the origin and development of the common lung-worm of cattle. The supposition that earth-worms are intermediately concerned in the production of the cattle lung-worm, has arisen solely from the circumstance that the writer, some time ago, conducted a set of original investigations, the results of which seemed to warrant such a conclusion. Before the truth of this position, however, can be universally accepted, it is necessary to publish figures and descriptions of the young worms, for the purposes of comparison and verification.

1. *Strongylus micrurus* (Mehlis).—This parasite is easily recognised by the relatively small size of the hood or bursa attached to the tail of the male, and also by the pattern of the rays, which are disconnected at their points of origin (Fig. 1). The male worm attains the length of nearly an inch and a-half; the somewhat stouter female reaching two inches and a-half. This parasite not only infests cattle, especially calves, but it also attacks horses and the ass. It has been obtained from the fallow-deer, and is probably the chief cause of lung-disease in the deer-tribe generally, although it is apt to be confounded with the next species.

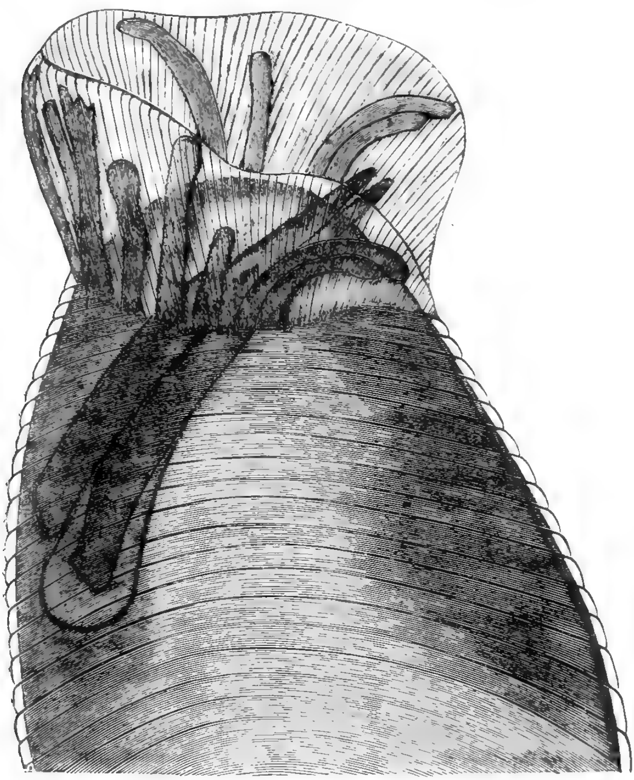
2. *Strongylus filaria* (Rudolphi).—This worm possesses a longer and larger hood, which is cleft or incomplete at the upper or front part, whilst the various rays are united at their common base. The male worm is commonly about an inch long; but, according to Gurlt, it sometimes almost equals the length of the female, the latter extending to three and a-half inches. This species infests sheep, especially lambs. It also attacks the goat, roe, and fallow, as well as the deer-tribe in general. Even camels suffer from its presence.

3. *Strongylus paradoxus* (Mehlis).—This worm is distinguished by the remarkably delicate and usually crumpled-up hood. Until comparatively recently, no one had been able to detect the presence of rays within the membrane of the hood. These rays are altogether peculiar in shape, the hood itself being four-lobed (O. von Linstow). This species is a common cause of lung-disease in swine; but, according to Alois Koch, it infests sheep and lambs. The male is three-quarters of an inch in length, and the female an inch and a half. It

is, doubtless, often overlooked by being mistaken for the preceding species.

4. *Strongylus rufescens* (Leuckart).—This entozoon is readily recognised by its remarkable size. The females measure six or seven inches in length, the males being about an inch shorter. The latter have a much divided or lobed hood, the form of the spicules being likewise very peculiar (Alois Koch).

Fig. 1.—*Tail of the Male Lung-worm of Cattle, showing the Hood, the Rays, and the Spicules. Magnified* 375 *diameters.*



This parasite is sometimes associated with the *Strongylus filaria* in the sheep. It is probably as abundant in England as on the Continent, where, as remarked by Krabbe, it "not unfrequently occasions inflammation of the lungs with more or less obliteration of the finest bronchial tubes."

5. *Pseudalius pulmonalis* (Alois Koch).—Though little known to English agriculturists, this small parasite is perhaps the

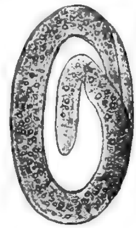
most remarkable, if it be not the most common, of all the lung-worms; and it is certainly the source of grave disease. The pathological appearances produced by its presence have been fully described by Alois Koch; and the worms themselves have been studied, not only by the Vienna helminthologist, but also in this country by Professors Brown and Axe, by the late Dr. Crisp, by the writer, and likewise long ago by Messrs. Sandie and Padley. On account of its hair-like form and excessive transparency, the coiled-up worm is readily overlooked. When unrolled, the full-grown parasite measures from five-sixths of an inch to a trifle more than one inch, the sexes being nearly equal in length. However, the thickness of the body of the female does not exceed the $\frac{1}{350}$ of an inch in diameter.

Life-history of the Worms.—As it is almost certain that in their main features all the strongyloid lung-worms of cattle and sheep pass through similar or analogous stages of growth, development, and metamorphosis, attended with and consequent upon both active and passive migrations, accompanied by a change of hosts, it is sufficiently obvious that a thorough knowledge of the phenomena exhibited by any one of the species cannot fail to serve as a clue towards a correct understanding of the life-history of all the others. Not improbably, however, the *Pseudalius*, or little gordian worm, pursues a somewhat different course of development. Certainly, indeed, the notion put forward by the late Dr. Crisp, to the effect that the sheep's gordius "is the early condition of both the *filaria* and the *strongylus*," is entirely erroneous. Although an honest and laborious investigator, the late Dr. Crisp's views about the entozoa, generally speaking, were untenable, whilst his last memoir on the so-called gordian worm is marred by palpable misunderstandings and by false interpretations as to the significance of the facts observed.

The Embryo.—If a full-grown female lung-worm from the calf be examined with a low magnifying lens, its body will be found to be crowded with eggs, of which a large proportion contain fully-formed young in the embryo state. I have reckoned that a large and well-developed worm contains at least 100,000 of such embryos; but Mr. Beulah, a microscopist and practical agriculturist, estimates that the lung-worm of the sheep carries as many as 300,000 embryos. If we reckon in this calculation the imperfectly-developed embryos, Mr. Beulah's enumeration is probably much below the mark. Anyhow, these figures do not fairly represent the full germ and embryo-producing power of one female worm; because, as long as the parent worm continues to live, she produces fresh germs and

embryos to supply the place of those that are already expelled. The conditions being favourable, it is no exaggeration to say that one female worm is capable of discharging several millions of embryos. When it is considered what large numbers of full-grown worms sometimes infest a single animal, the number of young that are expelled from the lungs of a single victim defies all calculation. One diseased animal may indirectly be the cause of infection of other animals. It is fortunate, indeed, that of the millions of embryos discharged, only a very small number of them come to perfection—that is, of course, relatively speaking.

Fig. 2.—*Egg of the Cattle Strongyle, with coiled Embryo inside.*



The embryo, when expelled, is still invested by its delicate covering (*chorion*), but there is no true egg-shell (Fig. 2). The little coiled-up worm is perfectly transparent, and of nearly uniform thickness, except at the tail end of the body. There is no trace of a mouth, and the only structures noticeable are fine molecules and granules. These particles are pretty uniformly distributed within the body. The slight movements of the embryo do not alter the oval form of the egg, even after it has been discharged from the parent worm. The egg itself measures about $\frac{1}{250}$ of an inch in length, and $\frac{1}{420}$ of an inch from side to side.

Fig. 3.—*Embryo of Strongyle from the Windpipe of a Calf. Length $\frac{1}{90}$ of an inch.*

The Free Embryo.—The lung-worms of cattle and sheep are commonly said to be viviparous. They were so described by Gurlt long ago. The statement is not, indeed, altogether incorrect; but it is rather misleading, inasmuch as the embryos are rarely, if ever, born without their egg-envelope. These parasites are, in fact, ovo-viviparous.

If, shortly after death, the windpipe and principal air-passages of a diseased calf be laid open, the frothy mucus within these tubes will be seen to contain multitudes of embryos, part of which remain coiled within their chorional coverings, the rest being free (Fig. 3). No marked difference, either of form or of structures, can be detected on comparing the free embryos with those still in the egg. It will usually be observed, however, that the molecules and granules have sensibly increased in numbers, and that they have become more crowded together

at the centre of the body. The heads and tails of the embryos are almost empty and of hyaline transparency. The free embryos give an average length of $\frac{1}{90}$ of an inch; and they are only a trifle below the $\frac{1}{1000}$ of an inch in thickness. Whilst free within the bronchial mucus, the embryos are more or less active, warmth promoting their activity. If, now, the dissection be carried further down the air-passages, the parent worms will be found plugging the smaller branches of the bronchi.

Expulsion of Embryos from the Host.—Under ordinary circumstances it must be clear to the most superficial observer that husk-affected animals are constantly discharging the eggs and embryos of parasites from the mouth and nostrils. The distressing paroxysmal cough favours such discharge. If further proof is wanting, it is only necessary to examine the so-called foam from the mouth and nostrils of the living animal, when the embryos will be readily detected under the microscope. It results from all this, that the first step in the migration-process consists in a transfer of the young worms to the outer world, passively. I mean, that the embryos do not pass on to the grass or into the soil of their own accord. They are driven out, mechanically, as products of the diseased state previously superinduced by their parents' presence in the lungs.

Destiny of the Embryo after Expulsion.—All manner of vague conjectures as to what becomes of the expelled embryos have been hazarded; but only such opinions as were founded upon analogy have approached the truth. The developmental phenomena in this class of entozoa are very variable, fourteen well-marked modifications of the process having already been described (O. von Linstow). Obviously, if it can be shown that, in any one of its free-life stages, this worm is more readily accessible to destroying agents than in the parasitic condition, a great point will be gained. The animal victim and the agriculturist would alike be benefited. It is in this practical view of the question of development that the following facts should be deemed worthy of consideration.

First Experiments.—Late in the afternoon of October 22nd, 1875, numerous embryos were placed in finely-sifted earth in the hollow of a watch-glass. The mould was rich and well moistened with water. At the same time two other vessels were charged with coarse earth, into which the germs and embryos of a separate parasite were indiscriminately cast. On the following day (or twenty-two hours after) living embryos were found in the finely-sifted soil, but in the coarse earth nearly all had perished. This fatality was probably due to the circumstance that shreds of the maternal organs of the parent worm had been introduced

with the embryos, and had caused the organic contents of the two larger vessels to decompose. However, some of the embryos within their envelopes were still alive.

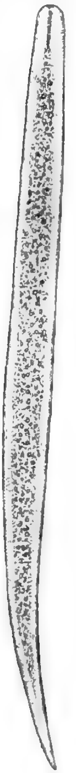
Another experiment consisted in placing several thousand embryos, still invested by their chorions, in water, which was allowed to evaporate before the fire. The increased warmth caused greater activity and hatching-out of the embryos; but when the water had entirely evaporated and the worms had become dried-up, all attempts to restore their vitality failed.

Effects of Soil on the Embryo.—On the 25th of October, a fresh examination was made both of the finely-sifted earth in the watch-glass and the coarse earth of other vessels, into which (after cleaning) I had placed a fresh supply of embryos. In each case plenty of living worms were detected, but they had undergone no change beyond a slight increase of length. After a lapse of seventy hours, neither mouth nor intestine had formed (Fig. 4). In some embryos the granules appeared to have increased, in others to have decreased. So numerous were the living embryos, that in about two grains' weight of the soil I counted a dozen specimens. Later, on the 27th of October, and at various other times, I examined the soils both coarse and sifted, always finding living embryos that had undergone no structural changes. The earth was kept moist by occasionally adding a few drops of water. As long as the embryos remained in the moist soil, there was not even any attempt made by them to change their skins. At least, I never saw any evidence of moulting or ecdysis. In this fact it would appear that the embryo of the calf's lung-worm differs from that of the worm of the sheep. Professor Leuckart's experiments with the young of *Strongylus filaria* proved that the embryos, when kept in moist earth, underwent a change of skin within a period varying from eight to fourteen days. He administered some of these metamorphosed embryos to young sheep, without, however, obtaining any positive results. It was clear that further changes of structure in the larvæ were necessary to ensure the success of feeding experiments. Without further insisting upon the fact of these differences of behaviour on the part of the embryos of the calf's

Fig. 4.—*Embryo of Strongyle kept in Soil for seventy hours. Length $\frac{1}{80}$ of an inch.*

and sheep's worms, respectively, I may add that when, on the 25th of March, 1876, I again examined some of the earth in which the embryos had been kept, the young worms were still living (Fig. 5). They had lived under these artificial conditions in a closed earthenware vessel, all through the winter. During the five months that had elapsed, the soil was kept moist, but the vessel was placed near the window, where the temperature was often below freezing-point. Still, the only change of structure noticed consisted in the formation of a mouth and short œsophageal tube, represented by a narrow chitin-line.

Fig. 5.—*Embryo of Strongyle kept alive in Soil for five months. Length $\frac{1}{80}$ of an inch.*



Earth-worms ingesting Embryos.—When, on the 25th of October, 1875, I was making a microscopic examination of the surface of the sifted soil that had been placed in a watch-glass (and subsequently deposited under a bell-jar, enclosing ferns), it happened that a sudden upheaval of the soil declared the presence of an intruder. This was a small earth-worm, barely an inch in length. Its introduction was accidental; but we may suppose that it had wandered from the dry soil of the fern-pan, seeking a moister and, therefore, more congenial soil. Be that as it may, I determined to ascertain if the earth-worm had swallowed any of my experimental embryos. Accordingly, after washing the worm under a water-tap, I snipped off the lower end of its body. The contents of the divided intestine of the worm were then allowed to escape on a glass slide, for examination with the microscope. This done, I had the satisfaction of finding strongyle ova and embryos in the earth-worm's fæces. Some of the freed embryos were larger than others. Not unnaturally, this interesting find suggested a possibility that, in the ordinary course of nature, earth-worms might be called upon to play the *rôle* of intermediary hosts to the strongyles of the calf, and perhaps also to the lung-worms of the sheep. On this hypothesis (which had not been previously framed by helminthologists), I resolved to continue the investigation; and, as a first step in the process, the unequal halves of the divided worm were replaced in soil—this time in ordinary earth that had not been sifted through fine muslin.

Characters of the ingested Parasites.—The more advanced

embryos taken from the earth-worm had slightly increased in length. Their heads displayed a mouth, leading to a short, straight, and simple œsophageal tube, lined with chitin ; all of them presenting more pointed tails than formerly, with their ends, in many instances, bent forward like the barb of a fish-hook. The internal granules were more crowded, rendering the position

Fig. 6.—*Embryo of Strongyle from the Intestine of an Earth-worm. Length $\frac{1}{65}$ of an inch.*

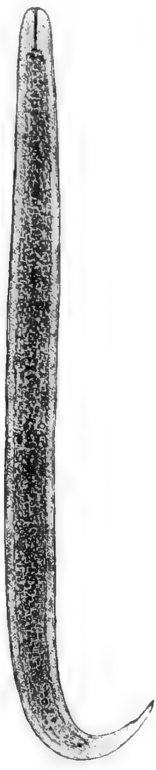


Fig. 7.—*Embryo of Strongyle from the Intestine of an Earth-worm. Length $\frac{1}{60}$ of an inch.*

of the future intestine more conspicuous, though as yet the differentiation gave no sign of any distinct intestinal wall (Fig. 6). The thickness of the body had not correspondingly increased.

Further Experiments.—The next step consisted in the selection and examination of fresh earth-worms from time to time. Some of these were purposely infected, and some were not. In this way I had repeated opportunities of confirming the results

obtained by the original find. I was also enabled to compare the ingested embryos with certain other small nematoids already known to science. It was thus rendered evident that our introduced embryos could not be confounded either with the so-called *Ascaris minutissima microscopica* of Goeze, or with the *Dicelis filaria* of Dujardin, or, again, with the remarkably worm-like little psorosperm (*Monocystis*) so fully described by Professor Ray Lankester. Altogether, eleven additional earth-worms were subjected to experiment. Without further particularising the results obtained, I will only mention that at midday on November 1st, when I examined one of the newly-infected worms, there were several embryos which showed, it is true, no very decided advance of structure as compared with what was seen in those which had been several days in the soil. Nevertheless, there were slight differences, the digestive organs being better defined (Fig. 7, p. 369). At this period, however, the weather was excessively cold—a fact which may have operated to retard development. The embryos, indeed, showed no active signs of life until the application of warmth revived them. In great contrast to this inactivity, it may be mentioned that one of the earth-worms harboured large quantities of ciliated infusoria (*Bursaria*), which rushed about freely over the field of the microscope.

Embryo passing into the Stage of Larva.—One of the most instructive finds resulted from the re-examination of the cut ends of the original earth-worm removed from the sifted soil, and placed in fresh non-infected earth. This occurred on the 27th of October. Both halves of the worm had retained their vitality, the tail portion being the more active moiety. Unfortunately, before I had time to examine its contents a professional interruption caused its escape. However, after again freely washing the upper half of the worm, I transferred its intestinal *débris* to a glass slide, and at once detected a number of larger and more advanced embryos under the microscope. They were in a state of marked activity, the largest specimens varying in size from $\frac{1}{55}$ to $\frac{1}{50}$ of an inch in length. There could, I reckoned, be no doubt as to their source, because individually they displayed different degrees of organisation, all of them answering to one and the same type. A distinct œsophagus was now plainly noticeable in the largest specimens, the rest of the intestinal tract being much more conspicuous than heretofore (Fig. 8). Not only were the characters of the fore-gut, mid-gut, and post-gut well marked, but in one specimen there was a complete series of chyle cells, arranged in pairs, most of the cells being furnished with large and strongly refracting nuclei.

In this connection I regret that I did not execute and retain more figures of the intermediate stages of larval growth, as witnessed in the embryos passing into the larval state. After immersing the larvæ in cold water, some of them soon became inactive and others were rendered motionless. I feared, indeed, that my investigations were already at an end, but the sequel proved otherwise.

Fig. 8. — *Embryo of Strongyle from the Intestine of an Earth-worm. Length $\frac{1}{50}$ of an inch. Passing into the larval state.*

Further Experiments.—Seeing that no more structural changes were likely to be observed in the earth-worm larvæ, it occurred to me to select a few of them and to place them on the moist fronds of ferns under a bell-jar. The pinnules of the ferns (*Asplenium bulbiferum*) being well covered with condensed vapour, I was able to place the young worms in dew drops, precisely similar to those that occur on the blades of grass in low-lying pastures. Accordingly, on the 27th of October, I deposited three or four specimens on the extremity of a marked frond. On the following day, after the lapse of only twenty-two hours, I carefully detached a few of the terminal pinnules of the frond, and placing these under the one-inch Ross objective-glass, I had the satisfaction of detecting one of the larvæ in the act of cruising about very actively. The addition of a drop of water increased its activity, and it became extremely difficult to follow the little creature's eel-like movements. In size it had so much increased that it was now actually visible to the naked eye, measuring as much as $\frac{1}{30}$ of an inch from head to tail.

The Larvæ undergo Metamorphosis.—The simple experiment above detailed is sufficient to show that when once the larvæ escape the body of the earth-worm, if the surrounding conditions are suitable, they will grow and develop with amazing rapidity. Their activities are correspondingly increased. The conduct of the single experimental larva just referred to was watched from hour to hour, whilst one or two of the others were examined occasionally. It so happened that all the free larvæ that specially engaged my attention turned out to be young males. Taking

them in their order of development, it appears that from the instant they are subjected to the new and natural conditions

Fig. 9.—*Larva of Strongyle undergoing Metamorphosis. Removed from the Surface of a Fern-frond. Length $\frac{1}{30}$ of an inch. One day old.*

Fig. 10.—*Free Larva of Strongyle removed from the Frond of a Fern Leaf. Length $\frac{1}{30}$ of an inch. Two days old.*

they proceed to undergo a change of skin (Fig. 9). Although I did not observe any previous ecdysis, I think that the process of

moulting here illustrated is the second that occurs in the parasite's lifetime. Whether it be so or not, the phenomenon is sufficiently striking. The moulting worm shows the old skin, forming a sort of loose sac which completely invests the new skin, leaving a large space between the lower end of the body and the point of the original tail. The shape of the now more or less metamorphosed larva becomes altered, the blunted form of its new tail being the most conspicuous feature. After a while traces of the internal reproductive organs make their appearance ; and one may soon discern a little sheath containing rudiments of the male spicules, as well as the commencing tube of the testis and vas deferens. The larva figured in this interesting stage of growth measured $\frac{1}{30}$ of an inch from head to tail, over all ; its enclosed and partly metamorphosed larva being shorter, or about $\frac{1}{45}$ of an inch.

Characters of the Free Larvæ.—After the lapse of an interval of twenty-four hours from the time at which the metamorphosing larva was sketched (as above), I again captured the worm. Its ecdysis was now complete ; not a trace of the old skin remained. Its sexual distinctiveness had become more pronounced, the two short and stout spicules being particularly well defined. Already, also, the tail end displayed lateral expansions of the new skin, forming the rudiment of a hood, which presented a wavy margin with crenelations due to the presence and support of five pairs of regularly-arranged rays. The tail itself ended in a minute awl-shaped projection. This specimen was in the condition here drawn (Fig. 10). It must be added that the now more fully-developed vas deferens and testis had pushed aside the mid-gut, the outer surface of the reproductive gland being dotted with polygonal, nucleated cells. The digestive tube itself had become more strongly marked, its walls being thickened by six-sided gastric gland-cells, of which there appeared to be a double row. The lumen of the mid-gut was indicated by a central dark line, but the hind-gut or rectum was somewhat obscured by other organs. The fore-gut had become very conspicuous, the chitin bands of the oral cup, the œsophageal tube and the bulb being all well marked.

A new Experiment.—One by one the few larvæ that I had reared on the fern-fronds were either dying or disappearing, so that by the 1st of November I had only a solitary larva left. This worm continued to grow rapidly, but its internal organs were not materially advanced in complexity. Wishing to obtain further results, I sought to place the larva under new conditions. Of course, to transfer it to the windpipe of a living calf would have given the larva a good chance of rapidly

acquiring sexual maturity; but I was deterred from this step by the consideration of the almost utter hopelessness of getting a positive result from this solitary transfer, and also by the hope, which I then entertained, of renewing my experiments on a much more extended scale. Under the circumstances, it occurred to me to imitate in some degree the conditions which obtain in nature, without resorting to the crucial experiment. Accordingly, I placed the larva in the hollow of an excavated glass slide, immersing the worm in human saliva, and raising the temperature to about 70° Fahr. At once, and this is a point of some significance, the little worm displayed extremely lively movements, such indeed as can only be fitly described as frantic. I have no hesitation in saying that the young worm showed powers of motion, such as would have enabled it (had it been in the windpipe of an animal) to pass rapidly down the air-passages. So far satisfied, I removed the slide from before the fire, and replaced it under the bell-jar of the fern pan. On the following day I found it still alive; but, in consequence of the lowered temperature, its movements were very much restricted. No fresh structural advances were observed. Again, on the succeeding day, without altering the environment, I renewed my inspection of the slide, and found that the saliva had become thicker and of ropy consistence. However, the worm was alive, and though at first lying almost motionless, it soon became tolerably vigorous when disturbed. Placing a thin glass-cover over it, and waiting my opportunity, I at length succeeded in obtaining an excellent view of its form and structure. My observations were now at an end. An effort to transfer the saliva and the worm to a glass tube (which I afterwards carried for a short time beneath the armpit) terminated unsuccessfully.

General Conclusions.—The foregoing experiments and observations unquestionably prove that certain larval worms (believed to have been reared by the introduction of embryos of the calf's lung-worm into the intestine of earth-worms) will, when they are set free, if subjected to suitable conditions, undergo a series of morphological and structural changes, and be attended with ecdysis. In their later stages these changes are accompanied by internal metamorphosis and rapid growth, being further signalised by a concurrent activity of movement. Eventually, the little worms acquire such a degree of organisation that both the digestive and reproductive organs are already well developed, whilst, at the same time, the young male worm displays an incompletely formed bursar, which bespeaks its strongyloid origin.

By these data it would appear that the embryos of the hoose

or husk-strongyle (*Strongylus micrurus*) require a change of hosts in order to arrive at the larval state. After their passive transference to the bodies of earth-worms, and subsequent escape into the soil, they undergo important changes; more or less moisture being in all cases necessary for their growth in the free state. What may be called the penultimate stage of life having thus been arrived at, it becomes more than probable that the final passive introduction of the worms into the lungs of the calf is accomplished during the act of feeding. In short, the young worms commonly gain access to their victims either with fresh-cut fodder obtained from low-lying pastures, or from the grass of swampy grounds, or, it may be, occasionally, from stagnant pond-water itself, so that in one or other of these ways the accomplishment of their ultimate destiny is amply secured. The organisation of the strongyloid larvæ is already so considerably advanced during fifty or sixty hours' freedom in dew or water, that when once they have been conveyed to the lungs it is evident that only a very few days' sojourn within their victims is all that is necessary in order to enable the young worms to arrive at maturity. In other words, about a week, or even less, will be sufficient for them to acquire their definitive sexual form, size, and other adult characters.

Practical Considerations and Suggestions.—One of the first questions likely to arise in the mind of the agriculturist is as to whether the foregoing facts throw any light upon his past experiences of the lung-disease of animals. Admitting that further scientific investigations are desirable, I would in the meantime draw attention to a few of the remarkable statements that have been made by trustworthy persons. At a meeting of the Quekett Microscopical Club, during my Presidency, Mr. Beulah (whose name has already been mentioned, and who farms at Brigg, Lincolnshire) stated that, of a flock of 72 sheep, all but two were on a particular day sent to graze on a meadow that proved to be a source of infection. The entire 70 grazing animals took the parasitic lung-disease, due to *Strongylus filaria*, and all of them died. The two animals that were not put into the field remained perfectly well. These facts were sufficiently interesting in themselves; but the most remarkable circumstance was that, when Mr. Beulah examined the dew on the grass where the animals had been grazing, he discovered that the moisture contained quantities of minute nematoid worms. Unfortunately, no specimens were preserved, so we cannot institute any comparison between Mr. Beulah's "finds" and the free larvæ reared by my experiments. If, as appears to me probable, the little nematoids discovered in the pasture were juvenile examples of the lung-worm of the sheep, they

would at least bear some general resemblance to the young of the cattle lung-worm. Here, therefore, is one point to be settled by future investigation. Again, as regards the possibility of the larvæ being swallowed by animals during the act of drinking, it is easy to understand how a brisk shower of rain might wash the tiny larvæ from off the blades of grass or other herbage into ditches and ponds. However, I suspect that it is not by the act of drinking that the larvæ are ordinarily transmitted to animals. No doubt, many persons are firmly of opinion that it is by the act of drinking, and by that alone, that infection occurs. Thus, when, in 1875, Mr. George Farrow, V.S., sent me the lungs of a calf for experimental purposes, he stated that the dead animal which furnished the organs in question was one of a herd of seven whose ages, respectively, varied from four to six months. At the time of his writing, the remaining six animals were progressing favourably towards recovery; a result which Mr. Farrow attributed to the employment of inhalations of turpentine and savin, combined with the administration of tonics. Mr. Farrow added: "The cattle are on a very dry and well-drained farm, but during the summer there was a great scarcity of water, and they were supplied from a stagnant pool, which eventually became dry. *This, in my opinion, is where the disease originated.*" Mr. Farrow may be quite right; but, *me judice*, it is more likely that the disorder arose from the nibbling of the calves, or their attempts to graze in the immediate vicinity of the ponds. Be that as it may, the methods of exact research alone can finally settle the question of the mode of entry. As regards the life-history of the parasites, it is, perhaps, of little moment whether the views I have here set forth be confirmed or not. At all events, until they receive verification, I am wholly disinclined to dogmatise upon the matter. Oft-repeated, continuous, and sustained observations on a larger scale are necessary. The most favourable periods of the season for commencing fresh investigations are towards the close of the summer and the early weeks of autumn.

XV.—*The Winter of* 1885–86. By Henry F. Moore, of Frome, Somerset.

The winter of 1885–86 was a remarkable one in many respects, its most salient features being its great length and long-continued cold. In many parts of the country the pastures gave out, under the influence of dry scorching easterly winds, at the end of the summer; the root crops—turnips especially—were everywhere a partial failure, and over large areas totally so; the stock markets in the autumn were glutted with stock, much half-fattened, which had to be sold at ruinous rates; the succeeding spring was abnormally late, and all early green food, common in recent years for spring feeding, was very scarce. All these facts combined to make the season a noteworthy one, and I was commissioned by the Council of the Royal Agricultural Society to institute enquiries among its members, and other practical men, into the lessons taught by the season, and into its effect on the Agriculture of the country.

Questions.

In obedience to the commands of the Council I sent out to some 450 members of the Society, the following series of fourteen questions :—

1. Where is your farm situated, and what are, speaking generally, its conditions of soil and climate?
2. What was your general experience of the summer and autumn of 1885, the winter of 1885–6, and the spring of 1886?

A.—THE SEASON AND LIVE-STOCK MANAGEMENT.

3. What was the effect of the summer and autumn of 1885 on the root crops of that year?
4. How did you provide food, and especially succulent food, for your cattle and sheep during the long winter?
5. Did the long winter prevent your obtaining green crops in early spring? If so, what arrangements did you make in consequence?
6. Have you had any experience of ensilage during the past winter? If so, would you kindly give it?
7. To what extent is shelter provided for sheep in your district? Did the experience of the past winter show that further shelter is required?
8. On this point, what were your experiences during the heavy and disastrous snowstorms of January 18th and 19th, 1881? Did the lessons of those storms result in more shelter being provided, or in any other alterations in sheep management?
9. How far, in your opinion, were the abnormally low prices of beef and mutton produced by the peculiarities of the season—the partial failure of the root crops, and consequent shortness of food; the increased quantity of stock in the country; and forced sales of half-fattened animals?
10. What, in your opinion, are the lessons the past season teaches us so

far as stock management and fodder crops are concerned? In the future, how could the English farmer prepare himself to meet such a season, so as to avoid the losses consequent on a wholesale sacrifice of stock?

B.—THE SEASON AND CROPS.

11. What has been the effect of the past winter on autumn-sown crops, and have you formed any opinion as to the teachings of the season on the subject of autumn or spring cultivation?

12. What effect has the season had upon your arrangements for spring cropping? Has it resulted in alterations being made; and, if so, what are they?

13. What has been your experience with regard to the winter wheat-plant and the lateness of the season for barley sowing?

14. Are there any other points of interest which you have noticed in regard to the past season?

THE SEASONS AND LIVE-STOCK MANAGEMENT.

In answer to these questions I have received in all some 350 replies. Of these I have selected the most noteworthy, and have divided them into five districts—four for England and one for Wales, exactly as the country is divided for the Government returns on agricultural statistics on acreage, live-stock, and production. As these divisions are shown in the statistical tables which appear with each volume of the Society's 'Journal,' there is no need for detailing the counties composing them. The first two Divisions are the corn-growing, and the third and fourth the grazing counties. Division No. 1 is the Eastern counties; No 2, the South-Eastern and East Midland; No. 3, the Western and South-Western; and No. 4, the Northern and North-Western. The selected replies, and the answers to Questions 1 to 10, are from the following:—

No. 1 Division.

Mr. John Sowerby, Conwold Hall, Caistor, Lincolnshire:

"1. On the wolds of North Lincolnshire. The soil is on the chalk, and the conditions of climate are in normal seasons dry, but of late years the seasons, except 1884, have been much more variable.

"2. The summer of 1885 was not nearly so fine as that of 1884. The autumn was ungenial and the nights frosty. Winter very protracted, and spring of 1886 was wet, cold, and backward.

"3. Some of the earlier sown root crops of 1885 did fairly well. The later ones bulbed badly on account of the coldness of the autumn.

"4. The same as usual. By folding sheep on the turnips, and drawing turnips for cattle in the yards.

"6. No experience of ensilage.

"7. No shelter is provided for sheep in this neighbourhood.

"9. Partly caused by the partial failure of root crops and forced sales of half-fattened animals in some parts of the country; but, also, the general depression has limited the power of many consumers to purchase.

"10. See no reason to make any alteration in stock management."

Mr. John Turner, the Grange, Ulceby, North Lincolnshire:

"1. Principally on chalk, with some strong loam and some marsh land.

"2. A very fine, early seed-time in the spring of 1885. Afterwards rather dry, but on the whole a very fine summer. A very long, severe winter and a very late seed-time this spring.

"3. We had one of the very best root crops ever grown.

"4. I had such abundance that I had to buy extra sheep to consume my roots.

"5. Never grew catch-crops for spring consumption, our climate is too backward for them, and generally we lose our turnip crop if we take any kind of catch-crop first.

"6. No silos in this neighbourhood.

"7. No shelter provided, except in lambing season. Impossible to provide shelter for the large flocks of sheep in this district, the expense would be ruinous.

"9. The low price of beef and mutton during the winter months was owing to several causes; the loss of the root crop all over the South of England which forced half-fatted animals into the market; the falling off in consumption owing to the lack of employment in large towns; and the importation of foreign meat which competes severely with our inferior sorts.

"10. Grew a greater variety of roots. Mangolds and cabbages might, when planted early in the summer, stand better than turnips grown later."

The Duke of Rutland, Belvoir Castle, Grantham:

"1. Light red soil, ironstone underneath. The situation hilly and exposed to the east.

"2. Summer hot and dry, fair hay crops exceedingly well got. Corn of good quality, short in straw, well harvested. Pasture short for stock, but latter did not suffer, farm being well-watered.

"3. Mangolds were a good average crop; swedes equally good. White turnips, coming up in the hot weather, were scorched and partially died; the second sowing, checked by night frosts, came to a poor crop; potatoes were sound and good.

"4. Good supply of roots. These were given with straw-chaff and a little wheat and barley meal.

"5. I don't provide green crops, having old pasture.

"6. No.

"7. None, only in lambing time.

"9. By the limited purchasing power of the working class in consequence of bad trade, chiefly."

Sir J. H. Thorold, Bart., Syston Park, Grantham:

"1. I have five farms in hand, beside my home farm. Two are on the oolite, or Lincoln Heath, the others on the lias in the valley. Four farms are within a few miles of Grantham, and one is four miles from Seaforth. The climate is dry.

"2. The summer was extraordinarily dry. The rains came before the wheat sowing was fairly commenced. The winter of 1885–86 was the longest recollected, and the spring of 1886 has been extraordinarily late and dry up to May.

"3. Mangolds did not seem to thrive even when there was a good plant, but grew in the autumn and came up with many rootlets and dirty. Turnips failed in many places on Lincoln Heath, but, when a plant was obtained, they proved better keep than had been expected.

"4. On my home farm I grow about 20 acres of mangolds and kohl rabi, 18 rows of each alternated; the mangolds are drawn off and the rabi consumed on the ground; and, with the exception of straw, I was well provided with food. On my other farm the beasts get straw and cake in the yards, and any roots we can spare towards spring.

"5. No spring green crops are grown in this district, except tares for horses.

"6. None.

"7. No shelter is provided. The ewes on grass land wintered badly, and the losses of both ewes and lambs have been considerable, except where I was able to give the ewes roots upon the grass. Ewes wintered on turnips, with a run upon grass over-night, have done well. I fancy shelter is desirable.

"9. I think the fall in stock was in the main occasioned by the failure of the hay and root crops. Sheep have more than recovered their former value. The fall in the price of milk and butter has reduced the value of milking beasts. The absence of competition amongst the butchers has enabled them to rule the auction markets; the introduction of weighing-machines would enable unskilled men to enter the trade and cause competition.

"10. As to roots, that the land should be cleaned, and for mangolds manured, in autumn, and some turnips. In a dry season the land should be ploughed for the last time in the morning, and sown up in the afternoon of each day."

Mr. Henry Woods (agent to Lord Walsingham), Merton, Thetford, Norfolk:

"1. Lord Walsingham has four large farms, including the Merton Home Farm, in hand. They are all in Norfolk, and comprise light, medium, and mixed soils. The lighter soils produce turnips, barley, oats, and rye. The medium soils grow roots (mangolds, swedes, and common turnips), barley, and wheat. The whole of the land is well suited for sheep farming. The climate may be considered rather dry.

"2. The summer and autumn of 1885 were most unfavourable, in Norfolk, for the growth of roots. The winter of 1885–86 and the spring of 1886 were most unfavourable for farmers generally, but more especially for flock-owners, and the consequence was a largely increased expenditure for feeding-stuffs to keep flocks of ewes in reasonably fair condition through the winter. Notwithstanding an increased outlay, many ewes have come out of their wool weak and bare of flesh. It will be readily understood that with ewes in this condition they produce less wool and of inferior quality as compared with wool grown on ewes which have been fairly well fed.

"3. The summer of 1885 was, as shown above, bad for the root crop in the Eastern counties. The autumn was more favourable where a plant of turnips had been obtained.

"4. By mixing silage with barley- and oat-straw chaff. The silage was of great advantage to horses, cattle, and sheep, and formed their chief supply of succulent food.

"5. No spring rye or other green crops were obtainable hereabout until *late* in the spring. We had to depend upon silage.

"6. I believe I may fairly say that I have had a good deal of experience of silage for some years past, and especially during last winter and spring. I need scarcely say that it was no easy matter to carry upwards of 70 head of horses, 100 cattle, and 2300 sheep, through a long winter and late cold spring, with a very short supply of roots, little straw (the corn crops of 1885 being light and short of straw), and an extremely scant supply of hay.

"However much we might have been disposed to purchase artificial foods, they would have done comparatively little good unless there had been the

means of giving with them a more bulky and digestible food to fill the animals' stomachs.

"Here then was an instance where the advantage of having silage was beyond all possibility of doubt.

"It is known by practical and experienced men that when straw on light land is of slow growth it is tough and indigestible; to have given animals chaff made from such straw, without the admixture of some other food more easy of digestion, must have had the effect of producing many ailments from which they would otherwise be free.

"On Lord Walsingham's farms in hand, the animals were fed on mixed straw chaff and silage, with a limited allowance of artificial food; they remained healthy throughout, and did remarkably well.

"Upon one farm the old shepherd most strongly objected to the idea of having a little kidney-vetch silage put into troughs in a forward fold, for the lambs to pick at when the few turnip-tops there had been were done. It was, however, insisted that the order must be obeyed.

"A few days after the silage had been given as directed, four lambs were taken with scouring, their coats staring, and they looked in anything but a satisfactory state. The shepherd came to me at the fold in a most doleful frame of mind, and said, 'That silage is, as I expected, *regular* upsetting the lambs, and you will see that it will kill a lot on 'em.'

"After carefully looking among the ewes and lambs, I saw what had caused the scouring of the four lambs, and then, to the shepherd's horror, I remarked, 'Now shepherd, understand me clearly when I say that the lambs shall have the silage as directed, if it kills the whole lot.'

"This seemed too much for the old man, and he did not say another word, but his countenance clearly showed what he felt. It was only natural that he should feel alarmed, for he has a pecuniary as well as a professional interest in the successful rearing of as many lambs as possible.

"I purposely kept away from the ewes and lambs for at least a fortnight, but told the bailiff to keep a sharp eye on them, and to let me know if anything further went wrong. I had no unfavourable report from the bailiff.

"The next time I went to the sheep, the shepherd lost no time in approaching me, and the look of his face showed clearly that he was out of his trouble. He remarked, 'I was *rarely* wrong about the silage upsetting the four lambs you saw. They soon got all right. Look at my lambs now, and see how well they are doing.'

"It was quite true that they were doing well, and have continued healthy and thriving ever since. It is said they are the best of lambs on any light land farm in the neighbourhood. The ewes had a mixture of silage and chaff.

"It is worthy of remark, that while a flock of ewes on a neighbouring farm did not do well during last winter and spring, and came out of their wool very low in condition, the lambs looking unthrifty and stunted, the sheep-shearers declared that they had seen no ewes this year anything like so fresh in condition or producing better wool, nor lambs looking more thriving and healthy than those on Lord Walsingham's farm, to which I have referred.

"I should perhaps add that our silage is made in close silos, and is well trodden and rammed after having been passed through the chaff-cutter. By incurring the slight additional cost of these operations we secure our forage with the smallest possible percentage of loss in its weight; and if the amount of acid developed is sufficient to indicate the progress of chemical change, it is not injurious to the animals consuming it, nor is it so considerable as in many approved samples of so-called 'Sweet' silage.

"7. As a rule, there is insufficient shelter for sheep in this district, but more has been provided since my lecture, on the 'Breeding and Management

of Sheep,' was delivered on the 23rd of December, 1863, when the following remarks were made:—

"'One thing has struck me in the large flocks of Norfolk, and that is the little care that appears to be shown, or rather, felt to be desirable, for the protection of the lambs. In large flocks, the shepherd is frequently overworked; the lambs are often dropped in very severe weather; there is very little protection for them; there may perhaps be fifteen, or twenty, or thirty pens, but there are not pens enough, and I have seen a great many lambs perish from this cause. Now it is of great importance to every flockmaster, whether great or small, to prepare a yard for his ewes. It is not necessary to have them in yards on a fine and mild night; but you should have a good and well-sheltered yard, abundantly supplied with pens, and then you can put your flock in it if the night becomes a bad one; because I feel quite sure, and I have proved it by my own experience, that any little outlay upon this matter is well repaid by the number of lives of lambs saved.

"'I have proved that a good yard, with sixty well-covered pens, may be put up at a cost of (in the first instance) not exceeding 11*l.*, and if properly taken care of when the lambing season is over, will last for several years. It may be put up again on any part of a farm at a cost of not exceeding 3*l.*'

"The lambing yard to which I referred is still in use, and likely to be for some years to come. The advantages of movable lambing yards over permanently fixed yards are much greater than many persons imagine. A movable yard can, each year, be placed where most convenient for ewes during the lambing season; and by having the yards on fresh ground, there is no fear of the ewes being tainted from any case of straining which may have occurred during the previous lambing season. This disease has broken out very *much more* in permanent lambing yards than in those which have been movable.

"In addition to the lambing yard I have named, the sheep folds are sheltered by fold cloths ($3\frac{1}{2}$ feet deep and each 60 feet long) fastened to the hurdles.

"9. Undoubtedly the short crop of roots of last year was the cause of many partially fattened cattle and sheep being forced on to glutted markets, which necessarily keep down prices. In addition to the shortness of the root crop, another cause may be assigned for sending half-fatted animals to market and auction, and that was, the necessity that too many persons found to raise money by disposing of anything they might be able to sell.

"10. This is a difficult question to answer, as so much depends upon locality and local circumstances. No rule can be strictly laid down. Every farmer ought to be the best judge as to what he can and ought to do under any difficulty that may arise. What might be suitable in one district would probably be unsuited to another district of quite a different character, and in a different climate."

Mr. T. Moore Hudson, Castle Acre, Swaffham, Norfolk:

"1. Mixed sandy loam. Various.

"2. The months of June, July, and August, were very warm and dry; autumn, fine; winter and early spring of 1886, very cold.

"3. An exceptionally good crop of roots, on all of which stock fatted well, and were exceedingly healthy.

"5. No. A plentiful supply of Drumhead cabbages produced a good supply of ewes and lambs.

"6. No. The only silo I know in this neighbourhood has been erected two years, and has never yet had a load of grass or other green food put into it.

"7. No shelter provided in this district, neither is any required."

Mr. Charles Howard, Biddenham, near Bedford:

"1. My farms are situated at Biddenham (two), Bromham, and Bedford. The soils are Oxford clay, Boulder clay, loam and gravel. (Full description is given in R. A. S. E. 'Journal,' vol. x., part 2, p. 582.)

"2. The drought of July, 1885, affected the corn crops on light soils, and a very poor crop of roots was generally the case. But we had a splendid hay crop of clovers and grasses, which was secured in the best and cheapest manner. The winter of 1885–86 was very trying to stock, also to the wheat-plant, which was thinned out very much by the biting winds. Keep has also been short during the spring, and it has been found an expensive season to the stock-owner. The drought also dried up the young clover seeds, so that a great deal of land has been ploughed up and sown with tares, peas, and beans. Many farmers had resown their clover after harvest, but the severe winter was too much for the young and tender plant.

"3. Extract from my summary of the year, September 29, 1885:—

"'In consequence of the severe drought, the root crops are much below an average; mangolds suffered from fly, and are very small, besides not being a full plant. Kohl rabi are not quite a full plant, but a fair crop. Swedes were "grubbed," and will, we fear, not be of good quality. Turnips after tares and trifolium, also on a late and rough piece of fallow, could not be sown until August 13th. My seven or eight acres of cabbages suffered from the dry weather, but proved of great value to sheep, cows, and pigs, from about the middle of June until the latter end of September.'

"4. Having a large breadth and fair crop of kohl rabi, I got through the winter very satisfactorily with my sheep; they had a greater supply of dry food than usual, one large crop of clover hay giving us a good turn. We used but few roots for cattle, but gave them 'slopped' food.

"5. Our late-sown turnips, with some rye and winter oats sown immediately after harvest, together with some mangolds, enabled us to get through very comfortably with all the sheep.

"6. No experience of ensilage.

"7. Shelter in open yards with hovels is provided for the breeding flocks generally. I have heard of one or two cases where losses have taken place for want of proper shelter.

"9. In consequence of the failure of the root crop, thousands of half-fat animals found their way to market, thus lowering prices. Mutton is now scarce, and has gone up in price. I think also there was a good deal of distress throughout the country during the past winter, which affected the demand for meat.

"10. Those of us who were farming in 1868 had a severe lesson from the drought of that year (see R. A. S. E. 'Journal,' vol. v., 1859, page 50). It would be difficult for farmers to prepare for what they really do not know will overtake them. It is a mistake for a farmer to be constantly changing his system; I never knew it succeed. It is wise to provide a succession of spring keep, and I know of no crop so valuable, and so easily and cheaply cultivated, as the cabbage. It has helped me through many difficult summers with all descriptions of stock."

Mr. John Webb (agent to Lord Brooke), Easton Lodge, Essex:

"1. The farms are in Essex, Leicestershire, and Northamptonshire. The Essex farms are generally on a cold clay soil, and in a rather humid climate. The Leicestershire ones have a clay soil, and cold, late, climate. Those in Northamptonshire, a good staple medium class soil, and a good climate.

"2. The summer of 1885 was very dry, but fairly good for corn crops on the heavy land, though the harvest was a late one. It was advantageous for cleaning foul lands, but owing to the drought of root crops—turnips in

particular—were almost a total failure. The autumn of 1885 and the winter of 1885–86 were very wet and bad; the seeding was a long and difficult work, and much of the corn was sown late and under disadvantageous circumstances. The spring of 1886 was also exceptionally bad and very late. We suffered greatly from frosts, wet, and cold winds.

"3. Very bad. Mangolds were not half a crop, and turnips of all kinds were an almost total failure.

"4. We could not provide succulent food; our hay, made in the summer of 1885, was exceptionally good, which was a great help to us; but beyond this the cattle and sheep were chiefly fed upon cake and corn (either purchased, or grown on the holdings), &c., &c., thereby putting the agriculturist to a heavy extra expense.

"5. Yes. We had still to depend chiefly on the stores in the granary.

"6. Yes, a little. I should say generally that it proved an assistance, combined with hay, or cake and corn.

"7. Only to a very slight extent. I consider that more shelter would prove advantageous. In the winters of 1880 and 1881, I provided a large flock of sheep with extensive shelters in the coldest part of Staffordshire, with very good results.

"9. My opinion is that the abnormally low prices of beef and mutton were greatly occasioned by: (1) Large forced sales of half-fattened animals, on account of the great failure of root crops: (2) Large forced sales of half-fattened stock, occasioned by the want of money to meet current payments, experienced by so many of the needy farmers.

"10. That we were almost entirely dependent upon our fodder crops for the support of our stock.

"If similar seasons recur, I would advise the English farmer (especially on occupations that consist chiefly of arable lands) to give more attention and more breadth of land to the cultivation of tares, lucerne, rye, &c., &c., and to make some portion of such crops into silage."

No. 2 Division.

Mr. Joseph Paget, Stuffyn Wood Hall, Mansfield, Notts:

"1. On the confines of the counties of Derby and Nottinghamshire. The soil is rather strong to very strong, and varies in thickness from a few inches to three or four feet. The rock below is of magnesian limestone. The elevation varies, probably, between the limits of 350 and 400 feet above the sea-level.

"3. In 1885, for the first season for many years, my mangold-wurzel was entirely free from grub. The plant was good in one field, which had been manured and ploughed the previous autumn, but a good deal was wanting in the other, which had been ploughed in spring, and had to be filled up with swedes. The average yield of the first field was fairly good. The early-sown turnips, both swedes and common, were remarkably good, there scarcely being a plant missing. The later sown were much injured by the fly, and neither came up nor grew well, because the land could not be prepared till the spring.

"4. Had abundance of roots, and purchased sheep to consume them. We supplemented roots by cut oat-straw, ½ lb. ground Indian corn, and ½ lb. cake *per diem*.

"5. Had sufficient roots to keep our stock till the green crops came in; the spring green crops were late.

"6. No experience.

"9. Mainly so caused till the spring, when, roots being generally exhausted and a large proportion of the fat or half-fat stock killed, the prices of well-fed cattle and sheep were decidedly higher.

"10. By growing a large acreage of oats. If they are cut before they are ripe, the straw retains a high value as fodder; and if this is cut into chaff, and mixed with ground maize or other cheap corn, a comparatively small weight of turnips will be required *per diem*."

Mr. Robert Loder, Whittlebury, Towcester, Northamptonshire:

"1. Soil, a medium clay; subsoil, clay and some gravel. Climate cold, but not unfavourable to agricultural operations on the whole.

"2. The summer of 1885 was very favourable for making good hay, but the quantity was not great. Swedes were a failure everywhere, and mangolds nearly so. Swedes and beans were a total failure. Other crops generally were an average. The winter of 1885–86 retarded farming operations very much, particularly as it was succeeded by a wet spring. Autumn crops were sown to a great extent on foul ground. The spring of 1886 was very backward.

"3. Bad, could hardly have been worse.

"4. A good silo of trifolium or clover was of great assistance. The sheep were on swedes (such as they were), assisted by a little cake, and I had a large and good field of rye, and afterwards some late-sown turnips. After that they were folded on clover. I had an exceptionally good crop of mangolds. In the spaces of failure I planted cabbage. Some of my neighbours failed in their mangold plant.

"5. No. (See above.)

"6. My experience of silos is, of course, limited; but I consider no farmer is safe, or no farm complete, without one or more. I chaff my green crops before I store them, as I consider they store better, and it is easier to mix them with chaff in the winter, and therefore more economical.

"7. Nothing besides the usual shelter during the lambing season, nor do I consider that any was required. As for the crop of lambs, I had (as usual) one and a half lambs to a ewe, on an average.

"9. Low prices had not much to do with the weather.

"10. No lesson that we ought not to have acquired before, namely, to keep our young stock warm, and fed *as well as possible*. Never let them 'go down.' When they are older they will have strength to take care of themselves."

Mr. William Smith, Woolston, Bletchley, Buckinghamshire:

"1. The soil is clay on mixed gravel and clay. It is all grass land, 183 acres having gone down since 1878. The climate is that of the centre of England.

"2. We had a good hay time, collecting a lot of good hay at a moderate cost in 1885.

"4. I buy a lot of foreign corn, grind a lot of it for cattle. The sheep have it whole.

"6. Ensilage experience I have had none, for I do not believe in the economy or usefulness of it.

"7. I have two good yards for my ewes to run in at night.

"9. Mainly due to a slack trade in our manufacturing and trading districts. We have not an overstock in the country. Farmers glutted the markets for the want of money to pay labour, &c., therefore the half-fattened things were obliged to go.

"10. As a grass-land farmer I am careful to have some old hay on hand. The foreigner supplies the corn. Therefore I can hold on to do the best according to the general trade."

Major F. L. Dashwood, Kirklington, Oxfordshire:

"1. In Mid Oxon. Soil, stonebrash. Climate, dry. It is called a light soil, but requires care in working, as if it were strong land.

"2. Summer of 1885, dry. Short cut of hay, but got well. Corn crops, plenty of straw but not a good yield. The autumn was fair for cultivation. A long frost in winter and changeable weather made it bad for the sheep on roots. The spring was late.

"3. Mangolds very good. The early planted swedes good, but catch-crops, after vetches, &c., of turnips a complete failure. One fine crop of turnips was entirely destroyed by the drought.

"4. Mangolds and swedes pulped, and mixed with straw-chaff, and a fair allowance of corn and cake.

"5. The changeable weather in winter and early spring injured the winter vetches.

"6. No.

"7. None, except for ewes in lambing.

"9. Partly owing to the bad trade in the towns, where reside our great consumers. The forced sale of half-fattened animals also reduced the price. The animals were sold, as there was no food, owing to the partial failure in root crops.

"10. The chief lesson I learnt was that, when most farmers had been and were suffering from want of food for the sheep, owing to the failure of the turnip-crop for early feeding, I found on visiting Mr. Russell's farm, in Kent, October 12th, 1885, very fine crops of kale: a crop of 3 feet high was being cut off with a bill-hook, and carted to the ewes, which were penned at night on clover-bank. By cutting off instead of feeding off, I understood Mr. Russell to grow two or three crops off the same stem instead of one only. The crop is thus more profitable."

Mr. John Treadwell, Upper Winchendon, Aylesbury, Bucks:

"1. The situation is on a hill, sloping into the valleys all around. The soil is a dirty stonebrash, varying to deep loam and clay. Conditions very variable.

"2. The summer of 1885 was most peculiar. We had good 'plants' of corn and mangolds, with a rapid growth, then cold checks; then a dry spell, and afterwards showery growing weather. We had, thus, fair crops of hay and corn, well got (except beans, which were a total failure), a light crop of mangolds, and scarcely any other roots.

"3. The root crops suffered from the drought, and then a blight seemed to take them, so that swedes and turnips scarcely came to anything; whilst mangolds were small in size, consequently about two-thirds of an average crop. Thousand-headed kale seemed to stand the season as well as anything.

"4. Mangolds being the chief root-crop grown upon my farm, we reduced the quantity usually given to the dairy cows, and gave more meal. We gave more clover-chaff to the tegs, and they did not eat so many mangolds, and the ewe tegs more particularly had to rough it, by getting a little kale, and clover and straw-chaff, with a small quantity of roots later on in the spring. The ewes are always wintered in the grass fields.

"5. Our green crops did not suffer through the winter being so severe, other than being rather later to begin with. Rye being very good, and vetches too, when ready.

"6. None whatever.

"7. Nothing provided, other than natural shelter.

"9. The low prices of mutton were caused in a great measure by the forced sales of sheep in the autumn and early winter through the shortness

of roots; but the price of beef has been kept down continually, so that must have been caused by great importations.

"10. There was not such a shortness of food altogether as to make much difference in future management."

Mr. C. R. Wainwright, jun. (land agent), Shepton Mallet:

"1. I allude more especially to several farms in West Berks which have been thrown on my firm's hands to manage. The soil is chiefly of a clay loam, with a chalky subsoil, and situated at an elevation of about 550 to 600 feet above the sea, and the climate somewhat cold.

"2. The summer of 1885 was exceedingly dry and warm, and very favourable for harvesting crops, which, on the whole, were good. The autumn was favourable for sowing winter crops. The winter was, on the whole, dry but long, and the spring unusually severe, resulting from the continued east winds and late frosts, delaying in consequence the cultivation of the land for spring crops.

"3. Generally speaking, the whole of the root crops were more or less a failure, owing to the continued drought of the previous summer.

"4. Owing to the drought of the previous summer sheep and cattle were kept on dry food only, it being impossible to obtain succulent food, owing to the failure of the root crops.

"5. Yes. Sheep and cattle were fed on hay and straw-chaff, and a considerable outlay was necessary in providing cake and corn to make up for the deficiency of the roots.

"6. No.

"7. Shelter is never provided for sheep in this district (West Berks), except during the lambing season, when protection to the folds is made by the shepherds, and the experience of the past winter shows that *no* further shelter is required when sheep are well looked after and carefully fed.

"9. Owing to the failure of the root crops and the consequent shortness of food, sheep only half fat were sold to avoid the cost of winter keep, which, when well done, amounted to 1*l.* per head. The forced sales of these animals accounted for the low prices of mutton.

"10. The present low prices of corn lead me to suggest that poor arable land in the high regions should be sown down either to sainfoin or other lay grasses, and not overstock your farm; thus, by growing less corn we reduce the cost of labour, and by not overstocking minimise the losses consequent on the wholesale sacrifice of stock, should a failure in the root crop occur."

Mr. Martin Sutton, Dyson's Wood, Kidmore, near Reading:

"1. A small farm of 130 acres on the lower slopes of the Chiltern Hills. Soil, a gravel on chalk.

"2. Summer of 1885. Wheat crop averaged 6 qrs. to the acre. Aftermath of grass, *nil*, through drought and east wind. Spring corn very light from the same cause. Autumn: cold and ungenial, wheat lying long in the ground before it germinated, and unable to resist the severe frosts which commenced at Christmas and continued almost without intermission till the middle of March, a great part of the time without sufficient snow to shelter the plant. Spring of 1886: cold and ungenial, with hardly a spring-like day, and a remarkable absence of sun. Drought until the middle of May, then excessive rainfall with low temperature to the end of the month, seriously throwing back all white crops except oats.

"3. Turnips and swedes a complete failure through drought. Cabbage very good and extremely valuable. Mangolds half a crop.

"4. Chaffed cabbage with barley-straw, sprinkled with malt-dust and salt. Each fatting bullock was allowed in addition 4 to 6 lbs. of wheat meal, with

4 to 6 lbs. of linseed-cake. Sheep (Welsh mountain breed) out on the grass all the winter, eating 1 lb. of cake with rough hay. After the cabbages were gone, the beasts went on very well without any other succulent food, and began to be drawn for the butcher the middle of April in very fine condition, and sold for exactly double what they cost a twelvemonth before.

"5. Trifolium being so late, I purchased a little green rye for a fortnight, but did not observe any perceptible improvement in the cattle, or any indication that they had suffered from the absence of green food.

"6. No.

"7. No shelter provided, except corrugated-iron building for lambing.

"9. The reasons you suggest are those which I should give, with the addition of the crippled state of the farmer's finances, and his credit being so bad as to make it impossible for him to rely upon his bankers for adequate assistance.

"10. The principal lesson I have learnt is the great value of the cabbage as a reliable plant, however great the drought, in producing a succulent winter food, more valuable than any silage. The numerous varieties now in existence suitable for successive feeding will largely make the farmer independent of the turnip crop or the silo."

Mr. C. de L. Faunce de Laune, Sharsted Court, Sittingborne, Kent:

"1. Soil varies considerably, being composed of chalky banks without soil, chalk, gravel, and brick-earth of various depths, and a little alluvial soil. Climate dry, and exposed to winds.

"2. Summer and autumn of 1885 very dry. Winter of 1885–86 a long period of frost and snow, but at no time was the snow visible many days. Spring of 1886 dry and ungenial; both crops and stock during the winter period did not do well. Hops on my farm were an entire failure.

"3. The summer of 1885 was dry, and root crops grew badly, and mangolds were of very little value for feeding. Thousand-headed kale grew fast in the autumn, and was a fair and valuable crop, and severe winter did not injure it to any extent. I grew no turnips, except a small piece which was planted very late, and which produced a crop of small roots.

"4. I used silage for sheep, and also a large quantity of threshed straw, besides artificial food, in addition to kale and the mangold-wurzel.

"5. Kale kept good until the early spring, which, with mangolds, lasted until the grass grew in the pastures.

"6. I made a considerable quantity of silage last summer of grass and lucerne, and in the autumn of the vines from the failed hop gardens, which proved to be of great value during the long severe winter, and when chaffed up with straw it proved an excellent winter food, as it seemed to moisten and give a flavour to the straw, which was then freely eaten by sheep. I consider it advisable to give a highly nitrogenous food to sheep, such as decorticated cotton-cake, at the same time when they are feeding on silage.

"7. I provide plantations of trees for the shelter of sheep, besides lodges and other shelters. I also consider that further shelter is highly desirable and necessary to give all the advantage this climate is capable of giving by ensuring the early growth of grass.

"9. I consider that the abnormally low prices of beef and mutton were caused more by the tactics of the middlemen than the shortness of the crops or forced sales of animals."

Mr. A. F. Parbury, Old Park, Rusper, Horsham, Sussex:

"1. North Sussex, in the parish of Horsham. The farm (150 acres) is favourably situated on a hill, 372 feet above the sea-level. The soil is clay,

mostly of a poor character for growing corn and root-crops. It is, however, mostly in pasture, which repays good treatment. The rainfall is rather above the average (about 29 inches per annum), but the land soon dries, as breezes are generally prevalent. New drains, however, would improve the soil, the present ones being more than twenty-three years old.

"2. There was considerable loss to the dairy owing to the dry summer. The loss of milk could not have been far short of 100 gallons per cow under the average. The want of water was severely felt, and the loss to cattle grazing and sheep was also considerable. The autumn of 1885 was one of the wettest on record, 12·89 inches of rain falling in three months. This brought a lot of grass in October, but it possessed little substance. The winter of 1885–86 has been an extraordinary one, no less than ninety-eight frosts having occurred, and sixteen of these were in March.

"3. The rains came too late in the autumn to be of much help to the growing root crops, and there was scarcely half an average, although cabbages did much better when sown in good time, May being a wet month. The transplanted ones suffered equally with swedes and mangolds.

"4. We had Drumhead cabbages up to Christmas for cows and bullocks. Hay was plentiful, and the stacks were severely drawn upon. After cabbages were consumed, malt culms were substituted for the cows (mashed); linseed-cake and Waterloo-cake were purchased, as well as peas and beans, for the stall-fed beasts. Sheep did not require much extra food (a little hay only now and then); being a hardy breed, we kept them (100) seven months in the pastures and had no losses.

"5. We had no green crops in spring except tares, and these often save the grass in a dry season, and are much relished both by horses and cows. We intend trying to get cabbages for spring feeding by sowing in August, as we find the frost has no bad effect on the close-leaved varieties.

"6. No; a neighbouring farmer put up an expensive silo the winter before last; but I hear it did not answer, and has since been abandoned.

"7. There are open sheds in some of the fields facing south, but the fields are mostly well sheltered in this county by woods and covers. No; although the frost was severe at times, there was not much snow, and the hardy breeds did not seem to feel the effects of the weather much.

"9. Prices were certainly very low last winter for beef and mutton. The previous winter we sold our fat bullocks by weight, at 5*s.* 6*d.* per stone (8 lbs.), but this year we only made 4*s.* 4*d.* per stone. This was partly owing (no doubt) to forced sales; farmers not having sufficient food of their own, and being afraid of buying expensive feeding stuffs, sent a good many beasts to market in an unripe condition. Many cattle were sold to kill at less than half their live-weight. The importation of dead meat (beef and mutton, &c.) from America and New Zealand must also have had a lowering effect on our markets. Many beasts weighing from 90 to 100 stone made at least 5*l.* less than the year before. One farmer who sold from 40 to 50 well-fattened animals last winter, estimated his loss at 250*l.* below the previous year.

"10. The lessons taught are that if it pays to farm at all, it will pay best to farm well. The best policy seems to be to get the land to produce as much as possible of the kind of food most suitable for the consumption of stock kept. The old rotations of cropping system are no longer applicable to our times. As it will not pay now to buy a large quantity of feeding stuffs, as much hay, turnips, cabbages, &c., should be grown to maintain the winter stock in good condition, and at the same time provide sufficient manure for the next cropping. Much arable land is now considered unprofitable, and the tendency is rather to make one acre produce as much or more than two formerly did; and the nearer a farm is brought to the condition of a market garden, the better it will be for the cultivator. Thus more liberal manuring

and judicious growth of crops is desirable; if at the same time good judgment is exercised in the selection of live-stock, a better foundation for success will be laid. It is possible for a man who pays an ordinary rent for his arable land to make it worth several of these rents, and thus double or treble its fertility, without a corresponding outlay."

Mr. A. Heasman, Littlehampton, Sussex:

"1. On the coast of West Sussex. The soil is a good medium substance, with brick-earth and subsoil dry, and sufficiently warm to carry stock during the winter months.

"2. The summer of 1885 was exceptionally dry; the succulent crops on the arable land were completely burnt up, and in some cases the clover died in August for want of moisture. The plant of wheat on this land is thin and bad.

"3. The early sown swedes and mangolds were the best, and these were severely attacked by grub and vermin. The summer and autumn were unkind for roots, and white turnips were a great failure.

"4. My farm being more than half pasture, my sheep were kept very much on grass, and folded on the stubble and land when the turnips failed, with a supply of hay at night; the cattle were yarded at night.

"5. Drilled a quantity of rye when the turnips failed, which I found very useful in March. The sheep refused to eat hay with the rye, so I was obliged to substitute corn and cake.

"6. No experience.

"7. A good yard and hovel for the lambing ewes is generally provided, and sometimes a dead fold; nothing more is required.

"9. Partly in consequence of the failure in the root crop, together with large foreign importations.

"10. I believe stock will do well on a much smaller quantity of roots than is generally given."

Mr. R. A. Warren, Preston Place, Worthing, Sussex:

"1. Between the South Downs and the sea, on the flat of alluvial rich loam.

"2. We had not the advantage of even a thunderstorm during the summer of 1885 on my farm. It was very dry. The past winter was not the severest I have known, but the longest and the latest.

"3. Less than half a crop.

"4. We managed with the roots and hay which we had, but purchased more feeding stuffs than usual.

"5. No, but they were unusually backward.

"6. No.

"7. None, except at lambing time. No further required.

"9. Shortness of food and forced sales.

"10. Such a season comes but rarely, and cannot be foretold, and a farmer cannot protect himself. He would be wrong not to farm for an average season, as before."

No. 3 Division.

Mr. A. P. Lloyd, Leaton Knolls, Shrewsbury, Shropshire:

"1. Chiefly cold clay, which has been laid down to grass. Medium climate; less snow and rain than the midlands as a rule.

"2. Never saw the wheat and oats look better than in the summer of 1885, the land having at last got warmed after the disastrously wet seasons which had preceded them. There was a great quantity of Dutch white clovers. The

seed-time was good, and winter-wheat looks well. Land ploughed in autumn and early winter crumbled to pieces like a garden when worked in April. This, however, was spoiled by the late heavy rains.

"3. Roots did well, the dry summer suiting the stiff land. As a rule through Shropshire, especially on barley land, the turnip crop was very short.

"4. I made a silo which answered well, and kept my 12 Jersey cows upon the silage some considerable period. It was, as the hay time was so good, composed of rubbish, such as sides of drives in the coverts, &c., which, however, the cattle ate greedily. I used Waterloo round cake, McKinder's lamb food (excellent) for lambs, and treacle.

"Yes; sowed rye for sheep food and some winter tares, which were considerably retarded.

"6. Already given. Shall repeat the experiment. In a wet time for hay should consider it very useful. One field I put by for ensilage, but the weather being so tempting, I made it into hay. My silo is an old pit originally used for soaking or pickling timber.

"7. No shelter for sheep is used, nor does it appear to be necessary in our district. Of course, ewes lambing had a shed and pens to run into, and were put up at night.

"9. By foreign competition; also at intervals, such as at or near rent days and Christmas, and the practice farmers have of sending their fat stock in at the same time for the same purpose, which is well known to the dealers and butchers, instead of dribbling them in and banking the money. I saw beef sold in Oswestry Christmas market at 4*d.* per lb.

"10. A good stock of hay for dairying cows, &c. A good stock of young cattle to come on. Orme is a dairying district, a greater growth of mangolds and more use made of cabbages, a wonderfully useful crop in my opinion for cold stiff soils. The tenant to stop at home instead of going to markets and fairs about three times per week, having nothing to sell or buy."

Mr. John Hill, Felhampton Court, Church Stretton, Shropshire:

"1. In the valley between the Longmynd Hills and the Edge Road (a continuation of Wenlock Edge), 5 miles south of Church Stretton, on the Shrewsbury and Ludlow Road, South Shropshire. The soil is variable; some stiff clay, but chiefly mixed with gravel. The subsoil is bad, being a kind of stony brash, with clay cropping up here and there. There is no depth of soil, and the climate is late and backward. There is little chance of cleaning fallows after harvest, or of taking any catch-crops.

"2. A great flush of grass, and heavy crops of clover and hay. A partial failure of the root-crop, followed by one of the longest winters on record, and particularly trying to outlying stock. A backward spring, and a scarcity of fodder and roots. Cattle had to be turned out early, and the feeding-sheep sold in their wool. Spring-corn went in well, but the cultivation for the root crop was much delayed by the continual wet, and the most disastrous flood in the memory of man in this district. No losses of stock or crop on these farms, but a large proportion of the stock had to be brought up again for some days from the pastures.

"3. It was nearly a total failure, on one farm entirely so, excepting 3 acres of mangolds, and about 4 acres of swedes, out of a total acreage of 22 acres sown with roots. The fly took the swedes twice, and then they were attacked by a grub in the root. They either were eaten off entirely, or their growth was completely stopped; the few that were left had no goodness in them.

"4. On one farm no roots were used in the yards; the cattle being fed on long clover-hay, straw, hay, and chopped hay and straw, the calves and yearlings getting in addition from 2 to 3 lbs. of barley meal. The breeding

ewes had no roots at all until the end of February, when they had a small cartload a day of swedes among 200 for a week or two, and then chopped clover and black oats during lambing, with about one mangold each thrown to them on the grass. I never had ewes do better; they had some hay during the frost on the grass. The yearling ewes had no roots all the winter, but ½ lb. of barley each, and a little hay in the frost; they kept healthy, and I had no losses. The wethers had no roots until December, but were fed on barley and peas, half of each, beginning at ½ a lb. up to ¾ lbs. each; no hay; after Christmas they had swedes cut for them on the land, to be followed with barley. I sold 100 out of 114 fat to the butcher the same day, on the 12th of April. No sheep died, and I never remember them doing as well on the same amount of food. I believe nothing comes up to barley and peas for feeding sheep, or to oats for lambing ewes. I also attribute their healthy condition to the dry weather, as they always stand cold better than wet.

"5. I never sow green crops for early spring use.

"6. I have had no experience in ensilage.

"7. No shelter is used excepting during lambing time, when a rough yard is made of hurdles bound with straw, on those farms where there are not proper sheep pens. My sheep did not suffer from the severe cold; in extreme weather wattled hurdles, or hurdles bound with straw placed in the form of a T, are a great shelter from the wind. The losses on the Church Stretton and neighbouring hills were very great from the continued heavy falls of snow.

"9. More produced by the badness of the manufacturing trade in the country than by any other cause. This, combined with the low state of the farmers' finances, had more to do with forcing sales than the want of keep; but of course the latter cause to a great extent increased the difficulty of holding on for better times.

"10. That stock of all ages can be well wintered without roots, on the home-grown produce of the farm; the large quantity of roots usually given is a waste, and of no advantage to cattle or breeding ewes. By a greater economy in the use of roots, by pulping the few that are used for cattle, and by being provided by their landlords with better accommodation in yards, where there would be no waste of the food and fodder that are used, and by having sheds in convenient places on the grass land where there is plenty of shelter, so that cows or other stock can be wintered on the grass, with a foddering of hay or straw daily. By clearing some of the rough pastures in August, there will be a good quantity of grass for winter consumption. This plan saves the other food, and I have found cattle do remarkably well in this way, as I usually winter about 50 head of in-calf Hereford cows on the grass; otherwise I should be overstocked in winter."

Mr. Thomas Hutton (Shropshire agent to the Marquis of Bath), The Hall, Ministerley, Shropshire:

"1. Soil mostly clay, and climate below the average for wet and cold, with high winds.

"2. The summer of 1885 was dry and hot for the first part, autumn more inclined for rain, which made it a catching harvest, but good for the turnip-crop. The winter was a very wet, cold one; very little wheat was sown; stock had to be housed very early; spring, a deal of snow and cold rain, and all kinds of fodder and turnips very short; cattle in very low condition.

"3. Root crops were very indifferent, being a long while in coming up; then getting much cut about with the turnip-fly, and never did much good, and ended in only half a crop.

"4. To make the best of the few turnips we had we used the pulper mostly,

cutting up all hay and straw, mixed with wheat-meal and malt-dust for young stock, with the same mixture for sheep, but using cotton-cake in place of wheat-meal.

"5. Too late for early green crops in spring; had vetches ready to feed off the latter end of May.

"6. None.

"7. The shelter for sheep in this district is very short, and undoubtedly it requires much more; those that were sheltered improved much the fastest.

"9. The peculiarities of season and loss of root crop mostly, reduced the price of beef one-third, the markets being overstocked with half-fattened cattle; what few were sent properly finished, and well, commanded a better price by quite one penny per pound.

"10. To winter-plough and manure for early root-crops; to use the cultivator in spring; and, above all, get the roots in early. The same applies to barley and oats, and all other spring crops."

Mr. Henry J. Sheldon, Brailes House, Shipston-on-Stour, Warwickshire:

"1. My farm (about 800 acres) is situated at the southern end of Warwickshire, in a hilly district, the land in the parish rising in successive steps to a great altitude, and the soil varying as it rises from strong clay to strong loam, medium loam to light sand on the highest ground, which is on the watershed from which the water runs both ways into the Thames and Severn. Being such a high district, the climate is cold, and the spring generally very late, and we have more than an average of rain. Some of the land is good, some cold and hungry.

"2. The summer of 1885 was, on the whole, a favourable one to everything except the growth of roots and second clovers. The hay-crop was very large and well secured. There was a fortnight's wet weather in the middle of harvest, which stained all the barley. The autumn was cold and wet, the winter terribly severe, the snow lying till the 19th of March. There had been patches of snow on some parts of my farm ever since December. Since then, with the exception of two weeks, it has been very wet and cold. Very high floods, ground saturated with water, and only about eighteen days that horses have been able to do any work on the strong or loamy lands.

"3. Most unfavourable. I succeeded in growing some pretty good swedes on the highest part of the farm, on the sand, and about half a crop of mangolds; but on the stronger and better land the roots never grew, and were much damaged by a grub at the roots, so I only had, on the whole, about a third of a crop of roots. Turnips planted after vetches and trifolium were a total failure.

"4. I was obliged to keep everything much shorter of succulent food than I liked, and substitute dry food for it. The ewe-tegs (now shearlings) lay on grass until the end of February, receiving a large quantity of clover-hay, oats, and bran. The ram and wether tegs were treated in the same way until Christmas, when they were put on swedes. The cattle had not roots till Christmas; straw-chaff mixed with some meal (oats and barley), and some of it moistened with linseed-soup, for the bulk of their food, and some hay at night. Since Christmas I ventured on giving them some pulped roots also mixed with the chaff, and I found I should then have sufficient to carry me through, with economy. I also gave them some ensilage from a stack, but much more dry food than usual, and they have got through the winter, on the whole, well; but the expense has been greater from having used much more corn in their diet.

"5. Seeing last autumn that the root-crop was so deficient, I planted a

large breadth of catch-crops, for the spring—18 acres of stubble turnips—but which failed totally—never grew; about 30 acres of rape, after harvest, which came in very useful for the ewes and lambs in the latter part of April, as, though not much, it was better than nothing; also 11 acres of rye, which they are just finishing, and 11 acres of trifolium, which they are just going to begin. These crops enabled me to keep most of the sheep off the grass, at the critical time of growth, and so give it a fair start. Previous to their being ready, the ewes and lambs and shearling ewes lay on the grass, with a good deal of oats, bran, &c., to help them.

"6. At the end of last June I made a silage stack of about 16 acres trifolium, with a great deal of shed oats in it. I pressed it with Amos and Hunt's Chain Gear; it was excessively hot for several months, but after Christmas it came out some first-class sweet ensilage. No waste, except about 7 or 8 inches at the outside, where it was dressed with salt. No mould, or any influence from the outside air, reached beyond that distance. I have given it, in conjunction with other food, to a large number of cow stock, who eat it well, and it does them well. I shall make more this year, being very pleased with it.

"7. None at all, except a shed and yard for the ewes to lamb in, and I do not keep them in it but very few days. Shropshire sheep do not require any. Even on the highest part of my land, where all my ewes are lambed, they lie out three or four days after lambing, in the grass fields. I put three hurdles, stuffed with straw, in the shape of a **Z** in the field, where the lambs can go to if they like. Cold does not hurt sheep, and it would be impossible to protect 1000 sheep from rain, so I only give shelter to rams preparing for exhibition and sale, in the summer after they have been shorn.

"9. The low price of beef, and the *particularly* low price of mutton last autumn and winter, were not produced by the increased quantity of stock in the country, but from the failure of the root-crop; all farmers saw that they could not possibly winter so many sheep as usual. Many who usually put their lambs to turnips, had none, so sold their lambs. The hill ewes the same, which would have been fattened and sold in the winter, were sold, barely *killable*, at Michaelmas. Cattle in the same way were sent into the market half-fat. Farmers saw no means of fatting them *well*, without going to great expense in purchased food, which they could not afford to buy; and also being very short of money, they were pressed into the market. Those who could afford it, fed them half-fat, and pressed them into the market during the winter; but what, most of all, reduced prices is the diminution in the *consumption* of meat; from the depression of trade and want of employment and money, there is not half the meat consumed in this district that there was previously.

"10. I do not think this season has taught us any more than previous ones had done, viz., that one should always plant more fodder-crops of *different* kinds than would appear to be absolutely necessary for the standing stock of the farm, so as to allow for a failure of some of them, or for an exceptionally cold winter and spring—particularly in high districts like this, for the spring; but it is impossible to beat the seasons, and in the event of such a total failure of roots as occurred in many places this year, nothing can save us from loss. Making silage stacks of aftermath-clover would be a good provision; but last summer the clover never grew, after it was cut the first time, sufficiently to do so, or even to be worth hurdling off for sheep, so that provision could not be made."

Mr. Charles Randell, Chadbury, Evesham, Worcestershire:

"1. My farm is in Worcestershire, and is 570 acres in extent. Climate very good, the soil varying from a gravelly loam to stiff clay.

"2. The summer and autumn of 1885 were good for everything but swedes

and turnips. The winter of 1885 was long, but not very severe. The spring of 1885 was most ungenial, and nothing so far (July 7th) has done well.

"3. To make myself understood I must go back to the commencement of 1885. My seeds were a failure. I therefore carted upon the land where they should have been (25 acres), about 20 tons of mangolds per acre, to be eaten by 590 tegs, with oilcake and chaff. The ewes and lambs (300) were folded upon old seeds with mangolds and oilcake, until the winter vetches were ready; the lambs were then weaned and folded upon them, still having some mangolds and cake. After the winter vetches they went to 10 acres of Russell's kale, which had been drilled in April. Meantime the 25 acres where the tegs had been eating mangolds had been cultivated behind them, and planted with, part spring vetches, part rape, part kale, part Sutton's early Drumhead cabbage, part late Drumheads; these, with oilcake and chaff, kept the lambs until November, when they went to turnips—of which I had only 10 acres—then to mangolds. These were not generally good. With me they were a great crop; they had been planted upon land which had been treated in 1884 as the 25 acres in 1885 described above, that is, where 20 tons of mangolds had been consumed per acre, the only difference being that instead of the after-crops being as mentioned, the whole field (31 acres) was in turnips, a very good crop, all eaten on the ground with cake and chaff; thus the preparation for mangolds was two green crops eaten on the land the previous year, and in addition, 5 cwt. per acre of fish guano when planted, and 1 cwt. of nitrate of soda when hoed.

"4. As to cattle, I have abundance of hay and straw, cut into chaff, with a mixture of boiled linseed and meal, given to about 100 head of all ages in covered yards, without roots, except to 35 feeding beasts, after Christmas. Sheep, mangolds, cake, and chaff.

"5. It caused the winter vetches to be later than usual, and the ewes and lambs to be dependent longer on mangolds. The lambs are now (June 26th) on winter vetches with mangolds and cake. Spring vetches will be ready when wanted, then Russell's kale drilled in April and May.

"6. I have no experience of ensilage except upon an estate where I was agent. It was first tried there in 1883, with entire success, and is now adopted on a larger scale. I entirely believe in it.

"7. Shelter for sheep is not required. I feed them during part of the winter in sheds and yards, but this is because in wet weather my land is unfit for them.

"9. The low prices of beef and mutton previous to February were owing, I think, greatly to forced sales of half-fatted animals, consequent upon a general scarcity of roots. Since February prices have been high enough.

"10. I can only suggest, increased growth of mangolds when the climate is suitable; they will do with liberal treatment on any soil, with a certainty —south of the Tweed—of double produce upon land adapted to turnips; with equal certainty, with proper treatment, where turnips cannot be grown, that is, upon heavy clay land. Yellow-fleshed mangolds, by careful selection of bulbs for seed, have become much increased in size; they keep longer, and are far more nutritive than others. In northern climates, where mangolds do not succeed, swedes and turnips do not often fail; but in the event of failure anywhere, and a consequent depreciation in the value of sheep, I would not sell, but keep them upon this mixture:—

"Boil in a furnace 80 gallons of water, add 3 pecks of linseed, let it boil 10 minutes, well stirred; add 3 bushels of any meal that is cheapest —usually maize or barley, or, better still, the two mixed; take out the fire, and stir the contents of the furnace till well mixed, then pour into a tub to cool, and mix with as much chaff as will serve 180 sheep for one day. I name these quantities and this number of sheep, because it is the number

upon which I first tried a similar mixture in 1878–79; they had no other food from October to April, and did very well. Sheep intended for the butcher would require oilcake or corn in addition, as on roots."

Mr. A. R. Hudson, Wick House, Pershore, Worcestershire:

"1. In the Vale of Evesham, about a mile from Pershore, the soil is partly stiff clay, partly strong loam, and partly light sand. The climate here, owing to its being a vale, is generally favourable for vegetation, the only drawback being that our fruit suffers sometimes from spring frosts when accompanied by heavy mist or fog.

"2. I had very good crops all round, excepting oats and beans, for which the summer was too dry. My root-crop (mangolds, swedes, and turnips) was a fair average,—the swedes, planted early in July, being extra fine. My cabbages (large Drumhead) were a remarkably fine crop. I secured in good order the grass- and clover-hay from upwards of 120 acres of mostly water meadows, and hence I was well prepared to meet the stock requirements for a prolonged winter."

Mr. Thomas Duckham, Baysham Court, Ross, Herefordshire:

"1. The soil is a sandy loam on the Old Red Sandstone formation, and suffers severely from protracted drought. There was a deficient rainfall during the autumn and winter of 1884–5, followed by a cold dry spring, greatly retarding vegetation.

"2. Only a few weeks of really summer weather, followed by cold ungenial weather, with great variations of temperature throughout the autumn months. This seriously checked the growth of root-crops, aftermath, clovers, and all other green crops. The grub of the daddy longlegs was most destructive amongst the root-crops.

"3. A most disastrous deficiency of moisture in the soil checked the growth, and rendered them an easy prey to the grubs and other insect life.

"4. Although my roots were far below my average, yet they were better than the average crops of the district. I forced on my wethers, and sent them to the butcher two months earlier than usual; and by the exercise of a rigid economy of roots with the cattle, and supplementing the use of roots with boiled linseed thrown hot over the cavings instead of pulped roots, I managed fairly well to carry through the winter a heavy breeding stock of cattle. I may here remark that I have great care taken of the cavings from all kinds of corn, never separating the chaff from them, but using them with pulped roots, or when (as during the past winter) I am short of roots, then boiling linseed and using it as described. Unfortunately, I had some very hard decorticated cotton-cake, containing large quantities of lumps of coagulated oil. The use of it after being merely crushed caused the loss of a very valuable young bull. I soaked the remainder, and after soaking it twenty-four hours I boiled it, and used it instead of linseed over the cavings.

"5. An extra quantity of linseed-cake for cattle, and spring grazing all the pastures with sheep.

"6. No.

"7. I have a convenient permanent lambing-fold. The past winter was an exceptional one, but I did not suffer any loss of sheep. I have a considerable acreage of pasture orchard, which provides some shelter.

"9. The low prices for both store and fat stock during the past year were the natural result of the increase of our flocks and herds, and the large number of animals that remained in Ireland, in consequence of the restrictive regulations in Great Britain enforced as a safeguard against the introduction of

foot-and-mouth disease during 1883 and part of 1884. When those restrictions were removed, the sheep and cattle were rapidly placed on the market, and depression followed. During the autumn of 1885 and the spring of 1886 the partial failure of root-crops and other food affected the price to the extent of at least 20 per cent., owing to forced sales.

"10. The experience of many years has shown me the value of saving fodder in an abundant year, so that I may be prepared in some measure against such a visitation as that we have recently experienced. When so prepared, a little extra expenditure for linseed, and for linseed or other cakes, has enabled me to tide over the trouble without loss, and sometimes with considerable advantage."

Mr. J. H. Arkwright (who sends the reports of ten neighbouring farmers and of himself and his agent), Hampton Court, Leominster:

"1. Farms neighbouring the valley of the Lugg, Mid Herefordshire. Soil, medium clay loam on the Old Red Sandstone formation, the low meadows being alluvial on gravel. Rainfall in 1885, 25·03.

"2. The summer was warm, autumn wet, winter long and cold, spring cold, and from three weeks to a month late; a very hard time for stock, especially the young stock.

"3. Swedes and turnips were from two-thirds to three-quarters of a crop. Very few mangolds or other roots are grown hereabouts.

"4. We fed with roots and hay (which was of exceptionally good quality) grown on the premises, and with cotton and oilcake bought.

"5. Spring grass, vetches, &c., were from three weeks to a month late. Vide Answer 4.

"6. No silos in this neighbourhood.

"7. Our enclosures being comparatively small, and the fences high, extra shelter is not provided in winter, extra food is more to the point.

"9. Foreign competition and the collateral depression in other trades.

"10. If we had the capital (which is wanting), we would employ more labour, and grow more peas, beans, vetches, and other green crops. Use fodder economically, and make certain that the quality of purchased food and manures is in reality what it professes to be, and worth the money."

Mr. H. Simmonds, Bearwood Farm, Wokingham, Berkshire:

"1. I farm about 1500 acres for Mr. John Walter, of Bearwood, Wokingham, Berks, and a considerable quantity of adjoining land for neighbouring landowners. The land varies much in quality, much of it being reclaimed from the forest, of a wet peaty soil, but other portions are loam on a clay subsoil, and being mostly underdrained and chalked, if well farmed, is favourable for the growth of corn and roots.

"2. The season was generally favourable in 1885, excepting as regards our oat, bean, and root-crops, which failed, owing to the continued dry weather. Hay, of which we grow largely, was heavy and well got. The long winter has been expensive, but does good in making our land work well this spring.

"3. Mangolds were a good average crop. Swedes half the usual weight. Turnips a total failure, excepting two fields sown very early.

"4. We managed to keep our stock without much trouble, the two-tooth sheep having been fattened on the swedes, and sold out by Christmas, and the tegs in the early spring with mangolds, giving them oilcake, with a few old beans. The cattle intended for market were fed on rough hay and straw cut up, mixed with mangolds, meal, and cake, and the young stock on hay, straw, and a little cake only, and they are doing well on the grass now. My

greatest difficulty was with 80 West Highland oxen, having to yard them, to which they did not take kindly, but they also are now nearly fat in the grass fields (having meal and oilcake in addition).

"5. No; our rye and vetches, although late, came to the rescue in time.

"6. No experience.

"7. We do not give shelter to sheep, excepting ewes during the lambing season.

"9. I consider that the low prices were produced by over-production at home; and our foreign supply, combined with bad trade throughout the country, causing a very bad demand at the butchers' shops.

"10. The great lesson taught is that of economy, and that when Providence again sends us ample root crops, &c., we shall be less wasteful, and keep a larger quantity of stock at less cost,—much fodder and other matter from last year's sheer necessity being found, when cut up and mixed with rice-meal, treacle, and other cheap ingredients, to have a feeding value beyond being simply thrown out as manure."

Mr. William Stratton, Kingston Deverill, Warminster, Wilts:

"1. On a chalk subsoil. About 600 feet above the sea-level, with a rainfall of about 36 inches.

"2. Summer of 1885 was very dry. Rainfall for three months (June, July, August), 3·57. When rain fell in September, cold weather set in, and no growth followed. The severe and protracted winter following, found autumn-sown corn in a weak backward state. March was characterised by severe frosty nights, alternating with sunny days; there being no snow to protect vegetation, great loss of plant occurred in the case of winter beans, vetches, and winter oats, as well as of wheat.

"3. Roots were a complete failure, even when well farmed and sown under favourable conditions.

"4. The crop of hay was good, and of first-rate quality; cake and corn were cheap; straw was also very good; stock was well fed, at great expense. Cattle were still selling at low prices when summer at last appeared; but sheep, having been killed down close in the autumn to save keep, were in May scarce, and mutton sold at high prices.

"5. Green food was very scarce throughout April and May, and farmers were compelled to feed off much grass which should have been reserved for hay.

"6. No experience.

"7. No.

"9. Scarcity of food was the great cause of the fall in the price of mutton; the low prices of beef throughout the winter and spring are difficult to understand."

Mr. James Greenaway (Bailiff on the Marquis of Bath's Wiltshire Farms), Bugley Farm, Warminster:

"1. Farms at Bugley and Norridge, in the parish of Warminster, and at Corsley and Upton Scudamore. Conditions generally are advantageous, being situated close to good roads, good markets, and a railway station. Land is a mixture of sandy loam and a great proportion of heavy clay low-lying land, with a subsoil of chalk and rubble.

"2. The summer of 1885 was generally suited to this locality, there being a good hay and corn harvest; but it was a most disastrous season for root-crops, except mangolds, which were generally good. The autumn and winter were most trying for stock farmers generally, in consequence of their having to supply a large quantity of artificial food at an enormous expense.

"3. Total failure, except as regards mangolds, as above, and swedes grown on good sandy loam, where a good yield was obtained after trifolium; but this was quite an exception, as but few pieces could be found.

"4. By distributing a very limited quantity of roots daily amongst the sheep, and by letting them graze a few hours on the pastures, and supplying them with plenty of water, which was done at a large expense of haulage.

"5. My sheep have never been without a small quantity of roots daily (as stated above); having taken great care to *pit* all roots intended for spring feed.

"6. None.

"7. No shelter is provided for store sheep in this district during winter, unless it is for ewes during the lambing season, and then fixing thatched hurdles as a temporary building is all that is considered necessary.

"9. For the most part, by the forced sales of half-meated sheep and cattle, consequent upon the general failure of root crops; the great expense of artificial food necessary to meet such failure being more than the farmers could incur in the depressed condition of agriculture.

"10. The necessary increased accommodation in shedding, so as to enable the farmer, with the use of proper mechanical appliances (a steaming tank, for instance), to use inferior fodder crops, which at little extra expense he can thereby do with great advantage. The necessity of securing stock consequently in bad seasons would be to some extent met by such a course as that suggested above."

Messrs. William B. Beauchamp, Norton Down, Midsummer Norton; A. J. Steeds, Red House Farm, Stratton-on-the-Fosse, Bath; and Walter Beauchamp, Stratton House Farm, ditto, Bath, Somerset:

"1. Principally pasture, and mostly on a lias subsoil. Moderately dry, there being no wet lands. All good, healthy, grassy pastures. In some parts, where the subsoil is a sort of sandstone, the land burns in dry weather.

"2. Last summer we had a moderate crop of hay where it was laid up. The grass grew very quickly from May 1st to about June 12th. From this date the extreme dry weather and scorching atmosphere very quickly dried up all vegetation, and some of the stock were reduced very much in condition, and hay serving commenced in August.

"3. Partial failure of mangolds, total failure of turnips and swedes. Globe and Intermediates kept well through the winter.

"4. No silage used, but grains to a large extent; also cake, corn, and chaffed straw. A large quantity of hay was in stock from the previous year, and this was nearly consumed. Cattle got dry and mixed foods, and sheep ran on pastures with chaff.

"5. Cattle were fed up late, and the turning out to grass was a fortnight to three weeks later than usual. What was missed more than anything else was the usual autumn grass. Pastures then were bare, and there was no grass to carry stock on to the winter.

"6. No; except as grains.

"9. First. The enormous aggregate increase in the stock of the country put a much greater strain on the ordinary resources of food. Many had more than they could feed, and were forced to sell. 2nd. We compute that in pasture and roots the year produced, at least, 40 per cent. under average. This created forced sales also. 3rd. Dairy produce realised such extremely low prices that needy farmers were compelled to sell their stock to raise funds to go on with.

"10. Undoubtedly every farmer should have sufficient capital in hand to

enable him to meet the exigencies of such a season, by allowing him always to have in store a third of a year's produce. For example, if an ordinary year would give him 100 tons of hay, he should have in hand, at the end of the next haymaking, a stock of at least 30 tons."

Col. H. A. Luttrell, Badgworth Court, Uxbridge, Somerset:

"1. On the blue lias, partly, some alluvial, in good condition. There are 207 acres grass, and 30 acres arable. Climate good.

"2. A stagnation of grass in July and August, very little growth in the autumn. I have seldom seen so backward a spring for grass, or so good a one for putting in spring crops.

"3. Mangolds good. No swedes. The latter crops failed all through the county of Somerset. In travels through many counties I saw no swedes.

"4. Plenty of mangolds and hay. Used extra cake.

"5. No. I had a fine plant of vetches, and they did well.

"6. No. I hate the stuff (!). It is more like muck than anything I know.

"7. No shelter for sheep. None required.

"9. Beef, from foreign competition; mutton, from failure of root crop, sheep being forced into the market before Christmas half fat, and on to March. The demand for butchers' meat did not come up to the supply.

"10. That the turnip is an overrated article of food, and that ewes especially do better on dry food with cake. Ditto, all grazing sheep. Go to the cake or corn merchant, and make the best terms you can with your landlord."

Mr. J. H. Risdon, Washford, Taunton, Somerset:

"1. The soil is partly sand (some sharp) and partly loam, on red marl. climate is good.

"2. The summer of 1885 was very dry, and the autumn good and growing. Winter frosty and open. Spring late, wet, and very cold.

"3. Disastrous.

"4. Used much less succulent food and more corn and cake than usual.

"7. I require no shelter for sheep, except the hedges, which are kept shorn.

"9. To the greatest extent.

"10. By keeping in a good season a rick of hay."

Mr. R. V. Langdon, Brompton Ralph, Somerset:

"1. Soil, light and heavy 'Rag,' very thin in places. Climate moist, being contiguous and joined on to the Brendon Hills.

"2. Summer of 1885 very dry. Crops of corn and hay moderately good and very well harvested, but no keep on the grass-land after the spring. The spring of 1886 was late, entailing extra expense."

Mr. James A. Caird, Northbrook, Micheldever, Hants:

"1. Centrally in Hampshire. Chalk formation. From 200 to 500 feet above the sea. Average rainfall 33 inches. The soil varies from the rather sticky clay that is found in places on the chalk, to the very thinnest covering of earth of the poorest quality that can be imagined; but the average may be said to be a fair chalk soil. Climate rather moist; no great extremes of heat and cold.

"2. Summer very dry and sunny, but not warm. Rainfall for June, July, and August only 2·89 inches. September wet and cold. October and November wet and rather mild. December, early part of the month, hard frost, latter part open weather. January, February, and March, persistent cold, frost almost every night, but never intense, till the month of March.

"3. The earliest sown turnips and swedes and the mangolds survived the

drought and produced about a quarter of a crop; a few acres of cabbage sown about April 20 made a very fair crop, but everything sown after June 10th was a failure.

"4. English sainfoin kept the sheep till the frosty weather set in. As a scarcity of roots was certain to occur, economy in their use was commenced early; some of the best of the swedes were pulled and stored in heaps covered with straw and earth, to be ready for the lambing time (January and February). The swedes lasted till the end of March. Oat-straw was chaffed with a little hay mixed, and given to the sheep. The ewes at lambing time and till weaning had oats and cotton-cake.

"5. On the 17th of March I find the following note in my Diary: 'Continuous frost since March 1, the ground frozen quite hard, ploughing almost stopped, and no sign of vegetation of any kind visible; not much ice in the country, as the sun wetted it; but in London the lakes all bearing, owing to the fog having kept out the sun's rays.' The thaw came on March 18th. The first available green food for the sheep was rye. On the 10th of April the ewes and lambs were put on rye with mangolds scattered on the ground, this was for their night fold, during the day they were on the Down. The ewe-tegs were folded on lucerne, also with mangolds. When the rye was finished, the whole flock (850 ewes, 300 tegs and 800 lambs) were folded on self-sown winter oats, and mangolds scattered; this lasted till May 3rd, when the lambs were weaned, and the ewes went to winter barley and the Down, and the lambs and ewe-tegs had trifolium, rye-grass, and mangolds. About the 10th of May the lambs went into English sainfoin, and the tegs into clover and rye-grass. The usual course is for the swedes to last till the trifolium and winter barley are ready, and for those crops to last till the tares are ready. Tares are a very poor crop, and are backward this year. No cattle are fattened by me in the winter.

"6. No experience.

"7. The sheep have no shelter provided for them, except the wattled hurdles which are used to make their folds. During the lambing time a yard is made with thatched hurdles, and a little half-covered pen is provided for each ewe for three or four days after the lamb is born. I do not think any more shelter is necessary.

"9. Owing to the scarcity of food, caused by the partial failure of the root-crops, great numbers of half-fattened animals were sent to the market in the winter. For these a very low price was obtained. Well-fed beef and mutton generally commanded a fair price.

"10. As far as the crops go, a scarcity can be foreseen in the autumn, and precautions have been taken accordingly. There is almost always a surplus of food at some time on a farm, which surplus might be preserved by some means to help to tide over a time of dearth. I do not myself think, however, that the English farmer should alter his scheme of management to meet the difficulties of one extraordinary season."

Mr. Alfred Mellor, Otterhead, Honiton, Devon:

"1. About 700 to 800 feet above the sea, 8 miles from Taunton and 10 from Honiton, Parish Churchstanton, Devon, and Otterford, Somerset. Climate, a greater average cold than the Vale of Taunton, about fourteen days later, to three weeks in unfavourable seasons. The soil varies a good deal, but is chiefly of a loamy nature, and in some fields peat, with a loamy clay subsoil; a gravel and stone subsoil over a large part is naturally drained in most fields.

"2. The worst but one or two in the last eleven years for farmers in this district.

"4. Had about 120 tons of sown silage, and used from 60 to 70 loads of crushed French gorse, and bought some hay and straw.

"6. My silage turned out good. I fed dairy cows on it, and had increased my supply of milk thereby; I should say about 1 lb. more butter per cow per week than I should otherwise have had. Ewes and lambs did well on it with other food.

"9. Bad season, aggravated by farmers being 'hard up.'

"10. In future, hay and straw must be stocked in large quantities, to enable farmers to take advantage of low markets for buying and high for selling."

Lord Poltimore, Poltimore Park, near Exeter, Devonshire:

"1. Mostly pasture, heavy loam and clay, and a little light sandy land.

"2. The summer was a good one for hay and cereals, but the drought in the autumn was bad for turnips. The winter was long and cold, and the spring the same.

"3. Excellent crop of mangolds, but an indifferent one of swedes, which were much damaged by fly and maggot.

"4. Mangolds lasted till June 1886, and we laid up grass for ewes and lambs, and fattened off wethers on young grass sown among wheat in spring.

"5. No. Our vetches, trifolium, and young grasses are very good.

"6. No. Have always been successful with our hay.

"7. Very little. No.

"9. Our markets were not cleared to the usual extent of barreners and other grazing animals, owing to the shortness of grass and the bad prospect of swedes and common turnips; and these as well as sheep remained on hand, and glutted our market for some months.

"10. Not to overstock your farm; to farm well so as to secure a good crop of roots at all times; and well top-dress trifolium and vetches, of which we have always a good crop."

Mr. W. H. Tremaine, Grampound Road, Cornwall:

"1. Soil light, and climate moist.

"2. The summer of 1885 was rather favourable for the growing crops up to the first week in harvest; then we had a continuation of wind and rain for many weeks; consequently a good deal of corn standing in stacks was much damaged, and harvest operations were very much hindered. The winter could not have been so severe here as in many parts of England, and the spring of 1886 was one of the most favourable we have had for many years.

"3. Root-crops generally up to the average.

"4. Had abundance of hay, straw, turnips, swedes, mangolds, and cabbages, and most farmers were able to keep their sheep and cattle well supplied until the middle of May.

"6. No.

"7. Hedges supply shelter, these being from 5 to 7 feet high, and placed round enclosures of from 5 to 10 acres.

"9. Importation of foreign cattle."

No. 4 Division.

Mr. S. P. Foster, Killhow, Mealgate, Carlisle, Cumberland:

"1. Chiefly limestone subsoil, chalk land rather heavy, not real barley land; both generally will grow turnips pretty well if properly worked. Climate moist. Old pasture on limestone subsoil very good.

"2. No fault with summer and autumn of 1885. Winter very long and cold. Spring of 1886 very late. No corn sown before April 20th. But few turnips sown yet, May 31.

"3. Nothing to complain of in the root-crop of 1885.

"4. Added a little cake.

"7. No shelter except for ewes lambing, or ewes and lambs.

"9. Foreign importations the principal reason, as it is the second qualities most affected. Farmers wanting money were compelled to sell half-fattened stock.

"10. The English farmer has more competitors than he used to have, and it is difficult for him to gauge foreign supplies. Mixed farms are the best. Winter keep pays as well, or better, than summer."

Mr. Thos. Bell, Hedley Hall, Whickham, R.S.O., Durham :

"1. The fields are undulating, the soil is generally thin, with a sandy subsoil. The climate, though late, is fairly good. The elevation varies from 400 to 600 feet above the sea.

"2. We were favoured with some showers in the month of June, 1885, which secured a good root-crop, and saved us from the effects of the drought which was so prevalent in England.

"3. Roots, good average crops.

"4. Keeping rather a heavy sheep stock we were obliged to supplement the usual quota of turnips with a liberal supply of hay and oats during the protracted snowstorm. The feeding hoggs also consumed a quantity of hay in addition to the usual food of turnips, cake, and corn.

"5. Do not count on green crops in spring, excepting young seeds and clover for the ewes and lambs in April.

"6. No.

"7. Artificial shelters are not usually provided for sheep here, except lambing sheds, which are held to be indispensable on low-lying and arable farms, where the lambs come early. In stormy weather a good shepherd always endeavours to have his flock either in the shelter of a fence, or in the natural shelter caused by the lie of the field.

"9. All the causes mentioned combined to bring beef and mutton down to the disastrous prices which prevailed during autumn and winter; the ruinous prices of store sheep at the autumn sales were, I think, to some extent due to a sort of panic partly caused by the heavy importation of frozen meat.

"10. Present prices of mutton teach us never to sell in a panic if it is at all possible to hold stock. To prevent disaster it is always prudent to have a good stock of hay, and not to be entirely dependent on the root crops. It is also important to secure a large portion of the root crops as early as possible."

Mr. W. T. Scarth, Staindrop House, Darlington, Durham :

"1. In the valley of the Tees, between Darlington and Bernard Castle, within the narrowest part of England. The soil to the north-west is alluvial, and black earth where boggy land formerly was—south and south-west on the boulder clay. The sea-level is 355 feet below us. The climate is a late one.

"2. The summer of 1885 was an average fine summer, the early part of the winter 1885 and 1886 being open and short of rainfall; but a heavy snow commenced in December with severe frosts which continued into March, and the spring of 1886 found the land in such a moist state, that it delayed spring sowing, and early cultivation of the land for the turnip crop.

"3. In the summer of 1885 I had one of the heaviest turnip crops I recollect on this farm. I was able to store it satisfactorily in excellent condition, and upon it were fed a large quantity of fattening and store stock, and sheep.

"4. I had an ample supply from swede turnips stored, which are pulped

with the addition of sweet silage and the usual allowance of cake. Cattle did well. Sheep had cut turnips, cake, and hay on the grass-land.

"5. No.

"6. My experience of sweet silage is very much in its favour. I found it both useful and economical food for mixing with other things. My silage was from Johnson's system of stacking.

"7. Shelter for sheep is much wanted by the farmers in this district in winter. A great many shelter-sheds have been erected upon the Duke of Cleveland's estate the last few years, and there is great demand for them.

"10. Proper covered buildings are the first necessary requirement of the farmer to meet his difficulties, preserving his manure, and keeping his stock in a proper healthy condition."

Mr. John Outhwaite, Crake Hall, Bedale, Yorkshire:

"1. A gravel soil and chiefly tillage land. The climate genial and early. Light cropping, as a rule, and the land requires frequent manuring.

"2. The summer was cold and backward, and the crops light, and yield very bad. Winter set in early in autumn, and very little wheat was sown; it is now looking very thin on the ground, and offers a very light crop; the spring has been one of the worst and backward I ever knew.

"3. The root crops, especially swedes, were a failure. Mine were very good. I find from experience that sowing on the flat is a very safe plan on this gravel soil, as I think it retains the moisture better until the plant is young. The autumn was fair for storing roots, and we find they are much better stored without frost, if possible.

"4. Had plenty of roots right through until May; but as a rule provender of all kinds was very scarce and dear; hay as high as 9*d.*, and in some cases 1*s.* per stone. I have frequently, when roots have been scarce, chaffed up my straw and made gruel of corn and linseed ground together. This poured over chaff, mixed with a few pulped roots, makes an excellent food for holding stock.

"5. Now cutting tares and rye, which is good feed, sown in October.

"6. No experience.

"7. No shelter is provided for sheep here. Have frequently kept sheep in the yards and houses, but find they do as well in the fields. I have sometimes had hurdles lined with light boards, but the sheep do not appear to care for them.

"9. Perhaps in consequence of the scarcity of roots the markets were overstocked in the autumn; but the great or principal cause was the short demand. A great many cattle and sheep get far too many roots. Fewer roots and more cake or corn would do better.

"10. Past seasons and experience have proved to me the necessity of covered yards for cattle; both for the comfort of the cattle and a saving of food, covered yards are indispensable; and for sheep I don't know anything so good as to provide plenty of dry food along with roots, both for warmness and feeding."

Mr. Teasdale H. Hutchinson, Manor House, Catterick, Yorkshire:

"1. One part of the arable land clay subsoil, the remainder on a gravelly subsoil. We have not had any climate (!) the last six months.

"2. A fine haytime, but light crops. Harvest very tiresome, but crops secured in good condition. A wet autumn, but managed to get autumn-wheat sown by the middle of November.

"3. Swede turnips simply splendid, and mangolds good.

"4. No difficulty in providing food; turnips and mangolds pulped and used with chaffed straw, &c.

"5. Could not get them here early, too far north.

"6. No experience of ensilage. Do not require any.

"7. During lambing time I had to keep all my ewes and lambs under cover; my feeding sheep eating turnips on the land did not require any.

"9. No doubt the partial failure of the root crops throughout England and Scotland had a great deal to do with the low price of young sheep in the autumn. The depression in trade, and the tenant-farmers' capital gradually diminishing, also helped to keep prices low.

"10. To pay great attention to the cultivation of root crops; to sow early; have the land fine, and put plenty of the best tillages into it; and when you have grown a good crop, take care to have it properly stored before the frost spoils it."

Mr. John Coleman (agent for Lady Ashton), The Mount, York:

"1. The land I managed for Lady Ashton is situated at Sherburn, South Milford, West Riding of Yorkshire. Climate equable, rainfall moderate, averaging about 26 inches. Soil generally strong clay, and flat; much affected by wet seasons, as the outfalls are sluggish. The area is about 201 acres, of which 73 acres are permanent grass, much of it requiring additional drainage, which is being carried out.

"2. The summer of 1885 was fairly favourable to the cereal crops and grass. The autumn was too wet for our country, although what wheat we had was well sown; but the long cold winter and spring, together with heavy downfalls of snow or rain, caused a serious loss of plant, and the prospects are now wretchedly bad. The spring of 1886 was one of the most backward and trying in a long experience.

"3. On such land as above, root crops are always difficult to grow, and the long period of dry weather in the summer was prejudicial. The start was late, and the plants were thin on the ground and grew very slowly until late in the autumn, when they mended a good deal, but never realised more than half a good crop. We had about 10 acres, partly swedes and mangolds mixed, and the rest swedes; and the yield did not exceed from 8 to 9 tons per acre, besides 4 or 5 cartloads of yellow turnips.

"4. We had thirty-two head of bullocks, coming two years, and eight cows and calves, six cart-horses, and a few pigs. The bullocks had been summered on the grass-land, with 2 lbs. a head daily of decorticated cotton-cake, and had done extremely well, partly owing to the artificial food and the improvement in the herbage, due to about 40 acres of the land having been dressed in spring with a mixture of artificials, consisting of ¼ cwt. steamed bone-flour, ¾ cwt. of nitrate of soda, and 2 cwt. of superphosphate (26 per cent.), costing 17*s.* 7½*d.* per acre. Our winter food comprised a small allowance of pulped roots with chaff, composed of hay and straw, and an allowance of meal, comprising decorticated cotton-cake, Indian corn, barley-meal, locust-beans, and 10 per cent. of fenugreck seed, and a small quantity of linseed-cake.

"5. The winter had no effect one way or the other, as strong land is not suitable for obtaining green crops in spring. We depended up to grass time upon our pulped roots, &c., as above, and by that time our bullocks were fit for market.

"6. None.

"7. None whatever. I should say that, when practicable, shelter should be provided. Animals protected from violent changes of weather thrive more quickly.

"9. It is difficult to answer these questions. It was supposed that the deficiency of the root crops would result in half-fed animals coming early to market, and this would be followed by scarcity; but throughout the whole winter and spring the supply was large and exceeded the demand, which was greatly reduced by the bad state of trade reducing wage-earning incomes. The roots were excellent in quality when preserved from frost, and cattle did well. The great increase in cattle stock in the country partly accounts for low prices; but although sheep have also increased, there has been a scarcity, probably because the taste of the wealthier classes is more for mutton than beef.

"10. The importance of more protection for our animals, especially the use of suitably ventilated covered yards. The more careful storing of the root crops, when they are matured, and the more general use of the pulper and chaff-cutter, with a mixture of artificial food, suitable for growth and feeding purposes."

Mr. Thos. Jennings, Staincross, Barnsley, Yorkshire :

"1. 300 acres in extent, and mostly of a thin greenstone soil, worth little excepting for sheep-farming; the grass, a third of the whole, fair, but not equal to feeding without assistance. Climate late, compared with East and South.

"2. Summer began dry and cold, especially cold and frosty nights; midsummer brought an improvement, with gentle rain and sunny days; autumn, much rain. Winter, very severe, with abundance of snow and frost; spring, 1886, late and very wet."

Mr. F. R. Jones, Lane Ends, Crossland Moor, Huddersfield, Yorkshire :

"1. About 350 acres (including plantations valuable for pasture) is table land, and 1000 feet above the sea-level; the soil is generally of a peaty nature well suited to the growth of grass, lints, and turnips, but too high for wheat; and oats are precarious, still I persevere with oats.

"2. The constant downpour of rain during the autumn of 1885 very much interfered with the gathering of hay and sadly spoiled the crop; but turnips matured wonderfully.

"7. Shelter for sheep is *indispensable* in high latitudes. I have several sheds, and when bad or snowy weather is probable, we entice the sheep into them, thus saving many lives.

"10. The best advice I can give to the farmer is always to keep the number of his stock well within the produce of his farm, so that the stock may be kept in good condition. The influx of foreign food has normally reduced the value of our animals, and it is doubtful whether former prices will recur to us."

Mr. George Drewry, Holker, Cark-in-Cartmel, Carnforth, Lancashire :

"1. Most of the arable land is reclaimed peat moss, and some land has been reclaimed from the sea.

"2. We had a fair average summer, and the winter was not so severe as many we have had, and root crops were quite an average in 1885.

"3 and 4. Root crops quite an average, and no scarcity of winter food for either sheep or cattle.

"6. Have one silo. As silage keeps longer than roots, it will be useful if the roots fail.

"7. We have not many sheep-sheds in this district.

"9. Owing to the depressed state of trade, want of employment and low wages."

Mr. George Roper (agent to the Earl of Lathom), Ormskirk, Lancashire:

"1. Soil generally a good loam, some with sand subsoil, and some with clay.

"2. Splendid weather for securing the hay, and good corn harvest, except the latter part. Winter severe and spring late.

"3 and 4. Root-crops good, except mangolds. Had more than could be consumed, and sold the surplus in April and May.

"5. Cut prickly comfrey in May, and am still using it.

"6. Silage unchaffed; very good, but little waste. Sheep were fed on it through the hard winter, and it was also given, mixed with hay, to cattle. Both cattle and sheep are fond of it.

"7. None at all.

"9. Affected more by foreign beef and mutton and live animals than anything else.

"10. No surfeit of stock through scarcity of fodder. Winter keep plentiful. Farmers compelled to sell in order to realise money."

Prof. J. P. Sheldon, Sheen, Ashborne, Derbyshire:

"1. Within what may be called the Peak Range of Derbyshire; that is, in the hilly district, which is here for some distance found running through both counties, carboniferous limestone prevails, for the most part; but on the Staffordshire side there is a good deal of igneous conglomerate, and in places freestone. The situation of my farm is some 700 feet above the sea-level; the climate is severe in winter, but still invigorating and healthy; the soil is for the most part a stiffish loam on a clay subsoil, and frequently on shale, or freestone subsoil. The land is all under permanent grass, and no cereals are grown in the district, save small areas of oats here and there.

"2. The summer, generally speaking, was a fairly good one for grass, following a cold, dry, and backward spring; the autumn was a grassy one—fairly so, I mean, as the summer was; the winter was severe, very long, very vicious at times in its intensity of cold, and the snow lay on the ground for about three months, greatly hindering farmers' out-door work. The year on the whole was worse than 1884, and the winter far worse than the previous one. The spring following it was dry and cold in April, giving farmers a good chance to pull up their work; in May it was wet and cold, with one or two very severe storms. The winter of 1885–6 was the worst, in my experience, for farmers.

"3. Root crops are not much taken in this part of the country; and on the neighbouring Derbyshire hills, the soil of which is sound and well adapted for turnips, the growth of roots is less than half of what it was some twenty years ago. Root crops last year were only middling; certainly not above an average, if even up to it.

"4. Hay crops were fairly good, and there was a fair supply of straw; many farmers, too, had stocks of old hay left over, but the old hayricks are much less numerous now than they were a year ago. Cattle and sheep are wintered generally on hay and straw, supplemented by a few roots, brewers' grains, and various sorts of purchased feeding-stuffs. For my part, I winter very little stock, being chiefly engaged in summer grazing. Hay this spring has been double the price it was three years ago.

"5. We don't trust to green crops in spring, save only to grass.

"6. Personally, I have no experience in the use of silage. I do not winter stock enough to make it worth my while to go in for it. A neighbour has

used it two or three winters, with satisfactory results, to his dairy cattle. He is decidedly in favour of it, and intends to continue the practice, though he is careful not to have too large a proportion of silage. Used with discretion, he regards it as a valuable variation in the food given to dairy cattle in winter and spring; it enables him to keep more stock, and he has not found any ill-effect from the use of it, either to the cattle themselves or to the cheese and butter they yield. He is, however, an uncommonly careful and systematic man.

"7. The shelter of stone walls and plantations is all that sheep receive, and it is considered enough. Lambing-sheds of a permanent character are provided on some farms, and are found very useful in the spring. This is a hilly country, as I have said, and there is consequently a good deal of 'land shelter' on most farms. Some say land shelter is better than any other, and cheaper.

"9. Drop of 20 per cent., caused about equally by what is mentioned in the query, and the worsening of trade.

"10. The main factors are wanting to enable the average farmer to avoid a wholesale sacrifice of stock—more capital, and more forage for winter. If he is short of capital, sell he must to meet his payments. He may help himself a little by a supply of silage, and so on; but as it is, he is being, or has been, rapidly drained of his capital, and cannot sustain the struggle much longer, unless times mend."

Mr. W. T. Swift, Toftes Farm, Trentham, Staffordshire:

"1. It is bounded on the north-west by Trentham Park, and on the south-west by Hanchurch Hills,—a belt of woods a considerable height, and which exclude a deal of the afternoon and evening sun. Soil naturally cold, but mostly dry, the wet portion having been drained several times, and the subsoil being of a stubborn retentive character. The climate is cold and late; frost and snow remaining late.

"2. The summer was generally dry and favourable for the harvesting of hay and corn crops, hay especially being got at a light expense, but in very varied quality. The winter was very long, changeable, and severe, extending far on in March, the first half of that month having been exceptionally severe and trying to stock—especially ewes and lambs. The spring was cold and ungenial."

Wales.

Mr. W. A. Darbishire, Nantlle, Carnarvonshire:

"1. On the Cambrian rocks; two-thirds of the farm is mountain pasture running up to about 1500 feet above the sea; the lowland at the bottom of the valley is about 600 feet above the sea, and is light land, chiefly gravelly subsoil, but in some parts deep peat beds; the valley runs east and west, having Snowdon at the east end, and being four miles from the sea at the west end. Climate moist and soft, and changeable, many days with rain, but few quite without sunshine; the sun rises above the mountains for only a short time in winter, but the summer is hot. Grass does not begin to grow till the end of May, and the winter storms begin in October. It is difficult to save hay at all, and it is never of good quality, owing to 'catching' weather.

"2. The summer of 1885 was cold and wet; hay was not made till August. Winter began by a severe frost early in December; it was then soft and wet until the beginning of March. On March 1st, there was a gale from the east, with a dry frost, causing heavy snow-drifts, which did not disappear until the middle of April. At the beginning of May vegetation was fourteen days late, and little work was done on the land until May.

"3. Root crops were, on the whole, good in this neighbourhood; the small quantity on my farm are very good. I took close on 80 tons of swedes from one field of 2 acres.

"4. I had prepared about 60 tons of silage and clover. I had small plots of cabbage alongside several pastures, and a small quantity of prickly comfrey, and about 120 tons of swedes. My sheep are Welsh mountain sheep; it is not customary to feed these at any season, but I taught mine to eat turnips and silage, and saved many ewes and lambs which would otherwise have died. My neighbours lost great numbers.

"5. Owing to the long winter I have been unable to get in any catch-crops of green oats for the silo. I could only wait for weather to work the land until April.

"6. Silage was most valuable. I used it for milking cows as a change of diet; for yearling and two-year-old bullocks, housed in a covered yard, as their main supply of food. I got the sheep to eat it, and in this respect it was most useful and handy. I have not any good statistics as to weight, &c.; but some of its advantages are the quickness and handiness with which a large number of beasts can be foddered; no chaffing, slicing, or cooking is required; the food is ready and succulent whenever it is taken out—and what is not used can lie by till next wanted; it is very wholesome food. Beef fed on it is like grass-fed beef as distinguished from stall-fed.

"9. Also foreign competition.

"10. I should gather from my own experience in such a mountain pasture as this, that the obstacles to be overcome are—long winter and hard weather for nearly eight months of the year; and therefore, the want of some cheap and succulent food, which can be stored away for use as required. I think the short summer should be used to 'force' heavy green crops, almost as much as to make hay in. The difficulties of climate should be neutralised by judicious shelter, and the quality of manure should be improved by covering in the shelter-yards. Speaking as a man of business, rather than as a farmer, I would say that it will be well to avoid attempting any product of a highly-finished character, and to aim at crops and produce which require a small amount of labour and are realised at shorter intervals—*e.g.* a $2\frac{1}{2}$-year bullock, fed on silage, with a small allowance of cake, as against a bullock $3\frac{1}{2}$ years, finished on cake and meal and turnips."

Earl Powis, Powis Castle Farm, Welshpool, Montgomeryshire:

"1. Rising from the banks of the Severn to an altitude of 950 feet above the sea-level; soil varying accordingly. Aspect is mostly southern, and the district is well-timbered, the climate being comparatively mild. Farm is principally grass, *i.e.*, three-fourths grass and one-fourth arable. Mixed system of husbandry, comprising dairy farming, cattle rearing and feeding, and sheep rearing and feeding. About an eighth part of the farm is subject to floods.

"2. The summer of 1885 was dry; splendid haymaking weather, but too dry for swedes. The autumn was very wet, injuring rather seriously the later grain crops, both in corn and straw, but repairing to a great extent the effects of the dry summer on the root crops, and causing a luxurious growth on pastures and meadows. The winter was rather long and severe, with violent changes of the weather. The spring of 1886 was considerably later than usual.

"3. The summer of 1885 suited the mangold crop well. It was too dry for swedes; the seed did not all come up at once; the turnip-fly made great havoc; some dry soils mildewed, and generally the plants got stunted in their growth. The wet autumn did much to remedy the effects of the dry summer on the swede crops.

"We used silage for the dairy stock. The feeding cattle had pulped roots with chopped straw and hay, and a mixture of ground barley and maize, some little wheat and cotton-cake. The sheep had roots on the pastures, with hay in racks; those that were feeding had some peas and cotton-cake in addition. We found that the cake bills were slightly increased in the past year.

"5. The large mangold crop proved invaluable this spring, and with some good hay carried the stock through to grass nicely. We have some mangolds still left at the end of May. A plot of prickly comfrey came in useful. No catch-crops are grown here; but a reserve of old hay is always kept on hand to meet an emergency.

"6. We preserved in a silo about 90 tons of green clover and rye-grass, put in uncut and weighted with stones. The contents we gave to dairy-cows during winter, two feeds per day of silage, and three feeds of hay. The quantity of milk was increased, the quality improved, and the cows kept well up in their condition.

"7. The district being well sheltered with trees and hedges, very little special shelter is provided for sheep. We find rain much more detrimental to sheep than frost or snow. The weather during the past lambing season was the roughest we have had for years, but with a little extra care and labour we pulled through and had fewer losses than usual.

"9. The price of store stock was lowered considerably by the failure of the root-crop, and consequent shortness of keep. The price of beef and mutton was but slightly affected by that cause, and that only for a month or two at the beginning of the winter.

"10. No special lesson, beyond encouragement to continue the use of the silo, and to always contrive to have an old haystack or two left in some corner, as a reserve fund to fall back upon. It is bad and short-sighted policy to use up every winter all the produce of the preceding summer, leaving the stackyard empty at May Day. If the English farmer would in a good season get up an extra quantity of hay, when it came a dry season with failure of roots, he might ensile his fodder-crops, which, with the old hay, would enable him to carry his stock through the winter, and so avoid the loss consequent on compulsory sale or shortness of keep."

Mr. J. Brockie (agent to Lord Emlyn), Golden Grove Farm, Carmarthenshire:

"1. In the vale of Towy. Three-fourths of the soil is good loam, varying from three to five feet in depth, with a gravelly bottom, and is capable of producing heavy crops. The remainder has a tendency to be clayey, requiring greater cultivation than the rest. The climate is humid, with a rainfall of 59·91 inches (for 1885) and variable temperature, and proves very fickle in the securing of crops.

"2. The dry summer of 1885 produced good cereals, but the autumn being wet prevented the harvesting of crops in good condition. The winter, mild up to December, favoured the root crop, but was followed by severe weather in 1886; and continuing so until the middle of April, made fodder dear and the sowing of corn late, yet the land pulverised by frosts made a good seed bed.

"3. Mangolds were sown in good time, and were not checked by the drought of early summer; but swedes suffered greatly, were backward in coming through, and worried by fly. The rains during the latter end of summer and autumn did great good, and the crops, though later in maturing, were an average.

"4. Cattle fed on swedes and mangolds (which kept well), hay and straw, crushed oats and oilcake. Sheep were provided with turnips and swedes, carted on to pastures, and hay.

"5. A slight addition of corn and cake.

"6. *Nil.*

"7. No shelter but that of banks and coverts is provided or required.

"10. Grow more hay than roots, and reduce stock before winter. Feeding stuffs (artificial) might be bought cheaper were farmers to unite in every district, and purchase at wholesale prices."

Mr. Jenkin Jenkins, Blaenfilyfn, Derry Ormund, Mid-Cardiganshire:

"1. About eighty feet above the sea-level. Soil, two-thirds light and shallow, and the remainder boggy—peat and clay. Climate, cold and wet. Natural produce of the soil, dwarf gorse and rushes; the former on the shallow, and the latter on the clay.

"2. Summer, cold and dry in May; June, mild and warm, and grass grew wonderfully fast, but hay was not above the average; July, warm and dry, and so was August. Straw average, but filled in the ear above average and well secured in the earliest districts; but September was wet, and a good deal of unsecured corn suffered severely. Winter very mild until Christmas, when we had snow, and cold followed until April. The outlying stock suffered severely, and thousands of mountain sheep died from cold and starvation; April dry and cold, and out-door work, which had been impeded by the frost and snow, progressed fast and favourably.

"3. Stock got low in condition in May, but improved in June and until the end of autumn, but suffered on a few farms in August for want of rain. Green crops were a failure on most farms except those that were sown early in May. Set in fair condition, but were destroyed by flies. Mine were sown early in June, and were wholly destroyed by flies. We sowed again, and got half a crop, notwithstanding the presence of flies. Sowed two acres of white turnips broadcast in August and got half a crop. The mangold-crop was above an average, and so were potatoes.

"4. My hay and straw were well harvested, but the low price of cattle in autumn induced me to keep a heavy stock in winter. My sheep are Welsh mountain sheep, and were outlayers, and got through fairly by the assistance of good shelter afforded by the hedgerows and young plantations of larch and spruce, planted for the purpose; and as the winter was exceptionally dry, which is suitable to sheep, they are now healthy and thriving well. My store cattle suffered a little for the want of a full crop of turnips, but I gave them a scanty allowance of barley and oats in straw instead. In April I got short of hay and straw; and as cattle were still low in price, I bought fodder, which was dear; and it would have been better for me to have sold off more cattle in the autumn.

"5. The long winter prevented me from obtaining green crops early in the spring, and the land was exceptionally bare till April. I had to buy hay and Indian meal, and the spring was not very late.

"6. No.

"7. There is no shelter provided for mountain sheep in the district, and very little, if any, by tenant-farmers for other breeds; but large landowners do provide shelter, and the experience of the last winter proves that shelter is good. Captain Vaughan, of Brynog, has a fine flock of Shropshire Downs, and his farm is naturally sheltered by hills, and I never saw his sheep look better than they do this spring.

"9. Peculiarities of the season has not much to do with the low price of beef and mutton.

"10. To meet such a season again I would sow more potatoes, mangolds, corn, and keep more land for hay."

Mr. W. T. Crawshay, Cyfarthfa Castle, Merthyr Tydfil, Glamorganshire :

"1. Partly in Glamorganshire and partly in Breconshire; that part in Glamorganshire being partly light clayey soil on coal-measures, and partly medium soil on limestone. Breconshire, medium soil, partly limestone and partly Old Red Sandstone. High-lying district subject to strong winds, continuous rains, and long winters. Few summer months' warm growing weather.

"2. Dry summer, but good for grain; green crops rather light. Very wet autumn. Very cold wet winter, with hard frosts and long continuance of N.E. wind and snow. The wet cold spring was very much against getting in root crops, causing them all to be very late.

"3. Green crops were rather light.

"4. Had a fair supply of roots, abundance of hay, and moderate supply of old grass for sheep.

"5. Long winter having killed cabbages, had to depend on mangolds for early spring, together with cake and corn.

"6. No.

"7. Very fair natural shelter on Glamorganshire side, none at all on Breconshire side. Had to provide shelter for them. Further shelter is required.

"9. Large quantity of stock on farmers' hands, and shortness of keep forced them to send stock to the market. They were glad to get anything for them.

"10. It is necessary to prepare beforehand, as far as possible, a good supply of fodder, and to give stock all the shelter and attention possible."

Scotland.

Although the enquiry was really restricted to England and Wales, I received a very interesting series of replies from Lord Arthur Cecil, who is farming, in company with his brother, at Orchardmains, Innerleithen, Peebleshire. Here the soil is light and stony in the higher parts, cold clay in the lower, gradually getting into a somewhat poor gravelly loam nearer the streams. The climate is very cold, and subject to heavy blasts. The noble Lord's experience of the past season was as follows :—

"2. Summer dry; grass considerably burnt. Roo crops bad at first, improved wonderfully in late autumn. From the New Year till the middle of April, almost continual snow on high grounds, with occasional violent blasts.

"Roots were above the average on the higher fields, but very bad on the heavier soils. Swedes were a complete failure. Ewes were fed on turnips for three hours every day, except when snow was too thick, when they had hay. The stored turnips lasted till the beginning of May, after which time there was a month of great starvation. Silage has not been used. The only shelter is provided by what are locally called "stells," which are of great value. These were put up in consequence of the great storms in January 1881, since which time six new ones have been built, and the old ones repaired and restored. These are walls built of dry stone, and are either round or shaped like a cross.

The lesson of the past season is told by his Lordship as follows :—

"10. Always have plenty of sweet hay (the only wholesome food for hill

sheep), and watch the weather closely as to be ready to get the sheep down to the stells before they are overblown."

The above replies give us an excellent picture, not only of varied experiences of the season, but also of the great variety of soil and climate with which different farmers have to deal in their annual manufacture of crops, meat, and dairy produce. There are certain clear indications of the leading features of the summer and autumn of 1885, the winter of 1885–86, running through the whole of the experiences, but the details of their practical bearing differ almost with every farm. The replies are, therefore, all of value, and give us, geographically arranged from north to south, a good picture of the agricultural experiences of a curious and difficult season, on nearly every class of farm in England and Wales. To both the arable and the stock farmer the season was a difficult one. To the former, by reason of the killing off of the clovers, and serious injury to all root crops by the drought in last August, the long, cold, and dry winter killing off or injuring the autumn-sown wheats and beans, and the late and difficult spring retarding all seeding operations. The ultimate effect of the winter and spring was not known at the time when many of these reports were written, but we now know that it has been most serious on all the crops of the year. There is hardly a crop in our harvest of 1886 that is an average one, the best being the promise of the root crop, a crop that, curiously enough, would be less affected by the winter and spring than the larger number of summer ones.

The stock-owner was seriously affected by the sudden drying up of the pastures by the drought of last August, the almost total failure of the swede and turnip crop, and the great injury to the mangold crop. During the long and severe winter, stock had to be kept under circumstances of great danger and expense, and the late spring and excessive cold prevented the stock-owner from obtaining those early green crops which are usually so welcome at the end of the winter. For the stock-owner, thus, the winter was lengthened at both ends. Those who did not care to risk the great expenditure of a long winter's keep (and many were unable to do so), found the markets glutted with half-fattened stock, and prices ruling so low that they only had the alternative of heavy losses by selling. It was only after January that prices became remunerative for fat stock, and only those with capital, who had held on, were able to realise fair values. Speaking generally, this was the position of agriculturists in every part of the country. How they met the

season at the least expense, is the subject of the remaining questions put in this enquiry.

The Meteorology of the Season.

Before proceeding with the agricultural lessons of the season, it may be as well first to give a short history of the meteorology of the autumn and winter. This was the subject of a very able paper read before the Royal Meteorological Society by Mr. C. Harding, one of the Fellows of that Society. This paper will be published by the Society in October, and may be usefully consulted.

Dealing with the winter at length and including also the first three months of the present year, I have received from Mr. Edward Mawley, of Berkhamsted, Vice-President of the Royal Meteorological Society, the following excellent report:—

"The winter of 1885–6 was, as regards the long continuance of unseasonably low temperature, the most severe that has been experienced in England for many years. The falls of snow were also singularly frequent and at times heavy, while the ground remained throughout exceptionally cold. December, January, and February are usually known as the three winter months, but the winter with which we are now dealing may be said to have lasted from the end of September to the middle of March, or for nearly six months. It is, moreover, necessary to bear in mind that these six months of wintry weather formed but part of an almost unbroken period of cold weather, lasting (if we include November, the mean temperature of which was about the average) from the end of July last year to the beginning of July in the present year. For it was no doubt owing to the great coldness and paucity of sunshine during the previous seven months, as well as to the continued frost prevailing at the time, that the ground had by the early spring become chilled to a very unusual depth. Indeed, we have to go back over thirty years in order to find in the Greenwich records a March in which the temperature of the soil at three feet deep was as low as in the same month this year. The severity of the weather having been more keenly felt in my own county, Hertfordshire, than in any other, a few particulars derived from observations taken here, at Great Berkhamsted, may prove of interest, and at the same time convey some idea of the most noteworthy features of this memorable winter. (1) The lowest air temperature recorded at four feet above the ground was 7°·4 (24½ degrees of frost) during the night of the 7th of January. On the same night a thermometer exposed on the surface of the snow fell to—4°·6, or to 4½ degrees below zero, thus indicating 36½ degrees of frost. (2) The same ground-thermometer, on as many as seventy-three consecutive nights (January 5th–March 18th), or for two-and-a-half months, registered temperature below the freezing-point. (3) Again, more or less snow was always to be seen on the north side of some few hedges every day between the 6th of January and the 19th of March. (4) The greatest average depth to which snow fell was 7¾ inches on January 6th. (5) During the first three months of 1886 snow fell on no less than thirty days. (5) Between March 1st and 17th the temperature of the soil at a depth of two feet varied only from 34°·5 to 35°·1, and at one foot deep only from 32°·8 to 33°·3, thus showing a change of but half a degree during over a fortnight. (7) The lowest reading at two feet deep was 34°·5 on March 17th, and at one foot 32°·8 on the 17th of the same month.

"Mr. Charles Harding, F.R.Met. Soc., in a very interesting and complete

account of the 'Severe Weather of the Past Winter,' given in a paper read before the Royal Meteorological Society in May last, states that even 'in the south-west of England there was not a single week from the commencement of October to March 21st in which the temperature of the air did not fall to the freezing-point. In many parts of the British islands frosts occurred in the shade on upwards of sixty nights between the beginning of January and the middle of March, and during the long frost which commenced in the middle of February and continued until March 17th, the temperature fell below the freezing-point in many places on more than thirty consecutive nights.'

"Taking the country throughout, the weather of the different months may be thus briefly described. October proved very cold, gloomy, and wet. November was of about average temperature, but dull and damp, and with a rather heavier rainfall than usual. December was cold, bright, and dry. In January the weather was very cold; but the sky was less obscured by cloud than is generally the case in mid-winter. The falls of snow in this month were at times very heavy. February, the coldest month of the whole period, continued persistently cold throughout; in fact there has not been for thirty-one years past a February with a mean temperature as low. It was also sunless, and the total falls of rain and snow were small. March was characterised by cold easterly winds until the frost suddenly broke up on the 19th, after which date the air-temperature never once fell to the freezing-point."

TABLE I.—METEOROLOGICAL OBSERVATIONS taken at GREAT BERKHAMSTED, HERTS, between October, 1885, and March, 1886.

	Mean of Highest shade Temperature.	Mean of Lowest shade Temperature.	Lowest shade Temperature of Months.	Lowest Temperature on Grass.	Mean Temperature of Soil at 1 foot at 9 A.M.	Mean Temperature of Soil at 2 feet at 9 A.M.	Total Rainfall.	Days on which ·01 in. or more of Rain or Snow fell.	Days on which Snow fell.
1885.	°	°	°	°	°	°	Inches.	No.	No.
October ..	51·4	38·9	30·7, 30th	23·0	47·9	50·5	5·05	19	—
November	47·1	37·3	29·0, 18th	17·6	43·3	45·1	3·73	21	—
December	42·8	32·4	20·4, 11th	12·1	39·0	41·3	1·11	14	4
1886.									
January	39·1	28·6	7·4, 7th	−4·6	35·9	37·9	3·94	22	14
February	36·4	28·1	20·1, 9th	13·1	34·1	35·8	0·83	8	6
March ..	45·1	32·6	16·9, 17th	8·9	37·3	37·3	1·62	15	10

The following Tables give the meteorological aspects of the season as shown at Scarborough, for the North of England; at Kenilworth, for Mid England; at Greenwich for the South-East of England; and at Frome for the West of England. The Tables are made up from the records of the Royal Meteorological Society, Mr. Symons's Rainfall Tables, from private memoranda supplied me by the Astronomer-Royal, Mr. T. G. Hawley, and Mr. W. A. Fussell, of Mells Park, near Frome. The Tables are as follows:—

TABLE II.—METEOROLOGICAL RECORDS for the NORTH OF ENGLAND, taken at SCARBOROUGH.

Months.	Temperature.				Rainfall.				Wind. No. of Observations.								
	Maximum.	Minimum.	Mean.	Average mean for previous years.	Days on which over ·01 inch fell.	Depth in inches.	Average of previous years. Days.	Average of previous years. Depth. Inches.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1885.																	
June	79·6	43·5	55·4	55·2	14	2·84	8	2·0	8	7	6	9	1	13	10	5	1
July	74·8	45·0	59·8	60·1	7	·86	18	2·8	6	5	5	2	6	21	10	5	2
August	71·7	42·9	55·3	58·7	14	2·27	16	2·7	13	11	5	3	2	11	6	9	2
September	70·0	38·3	53·9	54·9	19	2·53	16	3·0	9	1	0	6	5	16	14	7	2
October	56·2	38·1	45·8	48·7	24	4·86	19	3·3	16	7	8	5	1	6	10	9	0
November	56·5	33·9	44·2	42·6	13	1·49	20	3·2	2	3	18	8	3	12	11	2	1
December	51·3	25·0	39·1	38·1	12	1·09	19	1·13	11	4	0	1	2	15	18	11	0
1886.																	
January	50·8	21·9	36·2	36·6	23	3·84	11	1·9	12	12	4	3	1	7	11	12	0
February	45·9	28·0	35·7	39·2	16	1·03	8	1·5	7	9	6	6	2	6	8	12	0
March	60·7	25·1	39·8	40·7	19	1·94	8	1·6	5	11	12	8	3	8	10	5	0

Table III.—Meteorological Records for Mid-England, taken at Kenilworth.

Months.	Temperature.				Rainfall.			
	Maximum.	Minimum.	Mean.	Average for previous years.	Days on which over ·01 inch fell.	Depth in inches.	Average for previous years. Days.	Average for previous years. Depth in inches.
1885.								
June	65·44	47·74	58·54	56·2	11	2·375	18	2·78
July	73·85	51·04	62·04	59·6	3	·095	19	3·78
August ..	64·33	47·90	56·42	59·0	13	3·295	14	2·49
September ..	61·77	45·78	54·34	55·6	21	3·335	15	3·44
October ..	50·31	38·77	44·16	46·9	21	4·325	18	3·96
November ..	45·78	36·60	40·96	42·9	20	4·010	19	3·20
December ..	42·41	32·36	36·92	39·1	12	·595	17	2·58
1886.								
January ..	39·26	30·01	34·76	35·2	24	3·090	13	1·73
February ..	37·34	29·00	32·57	40·6	7	·595	18	3·17
March	44·58	35·97	38·42	40·9	13	2·600	12	1·72

Table IV.—Wind Observations at Kenilworth (Mid-England).

	N.	N.N.E.	N.E.	E.N.E.	E.	E.S.E.	S.E.	S.S.E.	S.	S.S.W.	S.W.	W.S.W.	W.	W.N.W.	N.W.	N.N.W.	Calms.
1885.																	
June	0	2	3	8	0	0	0	3	0	4	1	6	0	2	0	1	0
July	0	2	1	4	0	2	0	1	0	3	3	7	0	1	0	7	0
August	0	7	2	10	0	1	0	0	0	6	0	2	0	2	0	1	0
September ..	0	1	0	2	0	2	0	1	0	13	2	3	0	2	0	4	0
October	1	2	0	7	0	1	0	0	0	5	3	4	0	3	3	2	0
November ..	0	1	3	11	0	3	0	2	0	2	1	5	0	0	1	1	0
December ..	0	3	0	1	0	2	0	1	0	10	0	7	0	3	1	3	0
1886.																	
January ..	0	2	1	4	0	1	0	3	0	6	5	3	0	3	1	2	0
February ..	0	0	6	6	1	1	0	3	1	0	3	2	0	1	0	1	3
March	0	2	2	2	7	2	1	0	0	5	5	2	1	0	0	1	1

Table V.—Meteorological Observations taken at the Royal Observatory, Greenwich.

Month.	Temperature.				Rainfall.				Number of Hours of Prevalence of Each Wind.									Sunshine.		Hours of Sun above Horizon.
	Maximum.	Minimum.	Mean.	Average for 40 years, 1841–1880.	Number of days on which 0·01 in. or more fell.	Average No. of days for 20 years, 1865–1884.	Amount in Inches.	Average for 40 years, 1841–1880.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm, or nearly Calm.	Hours in each Month.	Average for 8 years, 1877–1884.	
1885.	°	°	°	°			in.	in.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.	h.
June ..	84·7	39·4	59·5	59·0	7	12	1·666	2·051	97	182	69	53	75	183	27	23	11	212	166	494
July ..	90·2	44·7	63·8	62·1	5	13	0·503	2·438	66	149	99	49	36	232	74	22	17	218	161	497
August ..	80·2	40·2	58·5	61·6	10	13	1·322	2·455	163	155	63	59	36	168	36	42	22	129	149	449
September	76·4	30·6	55·1	57·2	21	13	3·732	2·295	80	47	18	41	84	316	81	47	6	97	110	377
October ..	59·9	31·5	46·1	50·1	23	15	3·410	2·938	108	53	52	70	27	185	127	105	17	60	76	329
November	58·2	28·1	43·3	42·8	17	14	2·827	2·228	31	137	163	101	27	181	45	29	6	31	51	264
December	50·2	23·3	38·9	39·9	13	16	1·127	1·789	113	64	39	30	64	264	122	36	12	22	21	243
1886.																				
January	51·5	16·5	36·1	38·3	22	15	3·679	2·072	113	47	39	59	70	212	129	56	19	35	26	259
February	47·8	20·6	33·7	39·4	10	14	0·562	1·467	86	233	106	52	65	46	38	5	41	27	39	281
March ..	64·1	20·3	39·6	41·7	15	13	1·138	1·447	56	96	162	76	62	193	70	17	12	73	107	367

TABLE VI.—METEOROLOGICAL OBSERVATIONS taken at FROME,* WEST OF ENGLAND.

	Temperature.			Average of Previous 9 Years.			Rainfall.					Wind.	
	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.		Average of previous 11 years.	No. of days on which rain fell.	Greatest quantity in one day.	Date on which it fell.	Northerly or Easterly.	Southerly or Westerly.
1885.	°	°	°	°	°	°	inches.	inches.					
June	70·06	48·43	59·1	67·72	48·95	58·33	1·29	3·06	12	·33	16th	20	10
July	75·33	50·61	62·97	69·45	51·44	60·44	·29	3·76	7	·10	19th	18	12
August	69·77	46·77	58·77	68·87	51·31	60·09	2·58	4·28	13	1·20	26th	25	6
September ..	62·03	46·13	54·08	63·60	46·89	55·22	6·15	4·26	24	2·70	10th	10	20
October	51·20	38·25	44·72	55·24	40·86	48·05	5·39	4·31	22	·89	9th	22	9
November ..	46·80	37·83	42·31	47·59	36·09	41·84	4·97	4·48	17	·74	29th	19	11
December ..	42·11	31·48	36·79	43·26	34·16	38·61	1·59	3·46	14	·42	5th	12	19
1886.													
January	40·23	30·52	35·37	42·43	33·09	37·76	4·86	3·62	24	·64	30th	15	16
February	37·2	29·00	33·10	46·47	36·20	41·35	·84	3·47	9	·28	38th	21	7
March	46·5	35·25	40·87	49·35	34·72	42·17	3·09	2·68	16	·61	28th	18	13
April	54·86	36·8	45·83	55·50	37·70	46·50	3·30	2·57	19	1·08	28th	19	11

* In this instance, it may be worth stating, the total rainfall from May 23rd to August 25th, 1885, was only 2·43 inches. For the first 18 days of March, 1886, the temperature varied from 29°·94 as a minimum to 41°·32 as a maximum—the mean being 35°·63. There was also a frost every night from the 2nd of February to the 17th of March.

Lord Emlyn's agent has also sent me a Table of the rainfall at Golden Grove, Carmarthenshire, for 1885, which bears out the fact that the failure of the pastures and root crops of 1885 was not due to any want of rain. In fact, the rainfall for the year was exceptionally heavy, being as below:—

Month.	Rainfall. Inches.
January	5·48
February	9·42
March	2·19
April	3·58
May	8·45
June	4·05
July	2·05
August	3·82
September	7·53
October	5·33
November	5·81
December	2·15
Total for 1885	59·86

In my own district there is not much to add to the Table given for Frome, except that the returns there do not show the excessive dryness of the air during the months of February, and up to about March 16th. This would not be registered in the usual way, as the wet-bulb thermometer was frozen up during the whole of the period; but it was indicated to some extent by noticing the difference between the ordinary shade temperature-thermometer and the dry-bulb thermometer, which was fully exposed to the current of the wind, and both faced the north. The dry bulb thus exposed stood often as much as 6° below the other, and this through the whole day and for days together. This is an important point to know, as it demonstrates the chilling effect of the north-east wind, and also explains how it happened that any water dropping, and that was freely exposed to the wind, remained frozen all day, even though the shade thermometer would be probably showing a temperature of 38°, or even 40°. The effect of such a wind as this upon vegetation and upon the cultivation of land must have been very great, and was really a repetition of the experience at the end of the summer. This is the explanation of the fact—to which Mr. G. J. Symons, F.R.S., drew attention in the 'Times,'—that for twenty-seven years at least, February had not been so cold as this year. "There were," he said, "only eight days in the month on which the temperature rose to 40°, and the ground was frozen every night but two. The characteristic of the month has, therefore, been not severe frost, but persistent—in fact, almost uninterrupted—low temperature."

From a short, but very interesting article on "the Spring of 1886," which appeared in the 'Times,' the following may serve to show the salient features of that period:—

"The season from which we are just emerging has been a remarkable one, for the persistency, if not for the extreme rigour, of its cold, and it may therefore be of some interest to give a brief notice of some of its leading features. Up to Christmas the weather had been fairly open, but soon after New Year's Day the cold set in in earnest, and lasted, with but little intermission, to the end of May. It was the month of March, however, which was specially inclement, and this month was ushered in by a snowstorm such as has rarely been experienced at that season, at least on the Yorkshire moors, while the temperature in Staffordshire, at Upper Tean, near Stoke, fell, on the night of the 6th to 7 degrees in the shade, and to − 7 degrees on the snow, a most extraordinary temperature for the month. This cold was general throughout central Europe, and at Vienna the same night was the coldest during the whole winter, the temperature falling to 3 deg. Fah., and several cases being noted of persons frozen to death. As for the duration of the cold in England, skating was carried on in London to a later date than in any season since 1845. At the close of March we had a brief spell of warmth, but April was cold, and the 'icy saints' in the middle of May again brought heavy snow to the moors of north and north-west Britain.

"We have said that the weather up to Christmas was fairly open, but, as a fact, the months of September and October had been unusually chilly, the former exhibiting the rare phenomenon of a decided frost, for the thermometer on the grass at Greenwich read 10 degrees below the freezing-point on the 27th. November and December were not particularly remarkable for either warmth or the opposite, though on December 11th there was some skating in the neighbourhood of London.

"The new year, however, set in with decidedly severe weather, and the snowstorm of January 6th in London was the heaviest since the memorable fall of January 18th, 1881. The frost during the month was intermittent and occasionally severe, and the temperature generally was below the average.

"The subjoined Table, compiled from the weekly reports appearing regularly in these columns, shows from the twelve districts into which the British Isles are divided, for the purpose of these reports, the average defects of temperature in whole degrees, for the first five months of 1886. It will be seen from it that the coldest month—for the time of the year—was February, for over the whole of England the temperature was at least 5 degrees below the average of the last 20 years. Ireland and Scotland were not quite so badly off. March was also very cold, especially in the south and west of England; but in the two subsequent months, though the temperature was in defect, it was not very far from its normal amount.

"A good idea of the persistency of the cold may be gathered from the fact that for a period of twenty-eight consecutive days from February 19th the *minimum* temperature never reached the freezing-point.

"The coming in of more seasonable weather in May has been characterised by very remarkable phenomena. The cold and snowstorm of May have already been noticed, but at that same date, May 11th to 13th, the rainfall in the Severn basin was quite unprecedented for the season, and produced floods which have not been equalled since 1792."

TABLE VII.—DIFFERENCES in whole DEGREES of ACTUAL TEMPERATURE, 1886, from the 20 YEARS' AVERAGE, for each MONTH.

	Jan.	Feb.	March.	April.	May.
Scotland, N.	−4	−3	−1	−1	−2
Scotland, E.	−3	−4	−2	−2	−2
England, N.E.	−3	−5	−2	−2	−1
England, E.	−3	−7	−3	−3	−1
Midland Counties ..	−2	−6	−3	−2	−1
England, S.	−2	−7	−4	−2	0
England, W.	−3	−5	−3	−2	−2
England, N.W.	−3	−6	−4	−2	−3
England, S.W.	−4	−6	−4	−2	−1
Ireland, N.	−3	−3	−2	−2	−3
Ireland, S.	−3	−3	−2	−2	−3
Channel Islands	−2	−4	−3	−2	−1

THE LIVE STOCK MARKETS.

Besides the meteorology of the past seasons, the markets had a very serious effect also, as I have before stated. The glut of half-finished stock towards the end of August had the effect of bringing about a continuance of very low prices, these continuing to rule until February. How these affected the sheep-farmer may be seen from the following Table of Prices which ruled at the Great Sussex September Sheep Fair at Lewes, as compared with the previous five years:—

Year.	Numbers.	Values.	
		Sheep.	Lambs.
		s. s.	s. s.
1880	23,000	38 to 60	20 to 44
1881	22,000	26 „ 63	15 „ 43
1882	18,500	45 „ 64	28 „ 51
1883	20,000	43 „ 64	24 „ 48
1884	22,500	36 „ 61	19 „ 44
1885	23,500	25 „ 51	15 „ 35

Even at these prices, trade was very slow, and many of the animals could not be sold. Prices were far below the average of the previous twenty years; and as rain had fallen, it was believed there would be a better prospect of keep. The prices for those sold was therefore higher than at either the previous or succeeding fairs in the district.

I was informed by a large Wiltshire flockmaster that he sends out 500 lambs (Hampshire Downs) as his draft each

autumn. The following are the figures realised for each of the three preceding years:—

	£	s.	d.
1883	1208	8	0
1884	949	0	0
1885	650	0	0

A number of facts relating to the sheep values in the North were given in the 'Newcastle Courant' in the autumn, together with the opinions of eminent agriculturists on the same. Mr. Jacob Wilson attributed the fall in values to the following causes:—

"(*a*) The recent enormous importations of mutton from New Zealand and Australia in a frozen condition, from the former country of a first-class quality; (*b*) the large importation of sheep alive from Germany; (*c*) the general importation of animal food, both in its live and dead state, from America, Denmark, Spain, &c.; (*d*) the great depression in trade and manufactures, whereby the consumptive power of the working classes is greatly diminished; (*e*) the importation of large quantities of colonial and other wool, which is a non-perishable material, and can thus be stored from year to year, to be put upon the market under the most favourable circumstances, and thus to practically prevent any important rise in the price of home-grown wool; and (*f*) the low freights at which the imports of food are brought to this country."

Other correspondents referred to the failure of the turnip crop and to the diminished agricultural capital and consequently forced sales of farmer's stock. A sheep farmer also sent his prices for three-parts bred sheep during the September of a number of years. This information was given in the following Table:—

	Draft Ewes, per Head.		Lambs, per Head.		Wool, per 24 lbs.	
	s.	d.	s.	d.	s.	d.
1870	48	0	27	6	31	0
1871	64	0	36	6	42	0
1872	64	0	46	3	51	6
1873	58	0	31	6	44	6
1874	46	0	23	6	41	6
1875	55	6	37	6	41	6
1876	53	3	28	0	33	0
1877	52	0	28	6	32	0
1878	57	0	27	0	32	0
1879	38	0	26	0	33	0
1880	48	0	28	6	30	0
1881	53	6	26	6	22	0
1882	64	6	38	6	21	0
1883	62	0	36	0	20	3
1884	55	0	28	6	21	0
1885	38	0	24	0	19	6

The above statements show at a glance that 1885 showed the lowest average of prices for the past sixteen years.

But it was not sheep alone that showed a reduction, for beef also showed a lower range of values than for some years past. I have been unable to obtain any comparative prices running over a series of years for any English market, but the figures for the metropolitan markets are given in each volume of the 'Journal,' and the reader may well be referred to these. At Aberdeen, however, prices for both beef and mutton were the subject of the following Table in the 'Free Press' of that city:—

BEEF, per cwt.

	s.	d.		s.	d.
1880.					
January	77	0	to	78	0
March	76	0			
June	80	0	,,	83	0
September ..	78	0	,,	80	0
December	75	0	,,	76	0
1881.					
January	73	0	,,	75	0
March	68	0	,,	71	0
June	67	0	,,	69	0
September ..	70	0	,,	73	0
December	74	0	,,	77	0
1882.					
January	72	0	,,	76	0
March	74	0	,,	77	0
June	83	0	,,	85	0
September ..	83	0	,,	86	0
December	82	0	,,	85	0
1883.					
January	79	0	,,	81	6
March	77	6	,,	80	0
June	82	0	,,	84	0
September ..	82	0	,,	83	6
December	80	0	,,	83	0
1884.					
January	79	0	,,	80	0
March	74	0	,,	75	9
April	75	0	,,	77	0
June	77	0	,,	80	0
October	78	0	,,	79	0
December	74	0	,,	75	0
1885.					
January	72	0	,,	75	0
March	68	0	,,	71	0
June	70	0	,,	73	0
September ..	68	0	,,	70	0
October	68	0	,,	71	6
November	68	0	,,	70	0
December.					
Early ..	67	0	,,	69	0
18th ..	66	0	,,	68	0
.. ..	68	0	,,	69	6

MUTTON, per lb.

	d.		d.
1880.			
January	8¾	to	9¼
March	10¼	,,	11
June	10½	,,	11
September	8	,,	9
December	8¾		
1881.			
January	8¾	,,	9½
March	9¼	,,	9¾
June	10¼		
September	9¼		
December	8¾	,,	9½
1882.			
January	9	,,	9¾
March	10¾		
June	10		
September	10		
December	9½	,,	10¾
1883.			
January	10½	,,	10¾
March	10½	,,	11½
June	10	,,	10½
September	10¼		
December	9½	,,	10
1884.			
January	9½	,,	10
March	9¼		
April	9	,,	10
June	9½	,,	9¾
October	8¾	,,	9
December	8	,,	8½
1885.			
January	7½		
March	7¾		
June	7½		
September	7½		
October	7		
November	7		
December	7¼	,,	7¾

Mr. Alexander Ramsey, the editor of the 'Banffshire Journal,' has also sent me a series of elaborate tables on values of farm produce for each week of each year since 1880. These show that during the entire autumn and winter of 1885, *top prices* per stone of 8 lbs. of best Scotch beef—and in the higher qualities there were less reductions in value than in inferior qualities—ranged from 8*d.* to 10*d.* less (or a penny per lb.) than during the rest of the year, or as compared with the average of former years.

Corn Markets.

The low prices of corn had in many instances the effect of causing stock-owners to substitute wheat for oilcakes in stock feeding, and many were enabled by economic mixtures of wheatmeal to winter their stock at a cheap rate. The following Table, which I have compiled from 'Dornbusch,' will give the prices of home-grown wheat for the past seven years:—

	1879.		1880.		1881.		1882.		1883.		1884.		1885.	
	s.	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*	*s.*	*d.*
January	39	3	45	11	42	5	45	7	40	2	38	7	33	7
February	38	0	43	5	41	9	46	0	40	11	37	3	32	8
March	39	7	45	7	42	7	44	7	42	3	37	0	31	10
April	41	0	48	1	44	6	45	11	41	11	37	5	34	9
May	40	11	45	2	44	5	47	3	43	2	37	9	36	7
June	41	9	45	1	44	6	47	5	42	10	37	2	33	6
July	44	6	43	9	46	5	48	5	42	2	37	0	33	8
August	49	1	43	11	48	6	50	0	43	6	36	11	33	4
September	47	5	41	2	52	3	43	11	41	10	33	9	31	3
October	48	10	41	9	47	1	39	7	40	5	32	3	31	4
November	48	9	43	9	45	11	40	10	40	3	31	5	30	8
December	46	7	44	1	44	7	41	2	39	6	31	1	30	5
Annual Average ..	43	10	44	4	45	4	45	1	41	7	35	8	32	11
Highest	49	2	47	6	50	5	49	5	43	6	38	5	36	7
Lowest	37	11	41	0	41	10	39	7	39	5	31	3	30	5
Range	11	3	6	6	8	7	9	10	4	1	7	2	6	2

The Snowstorm in January 1881.

Question No. 8 referred to this snowstorm, the details of which were very remarkable, and are given in full in Symons's 'Monthly Meteorological Magazine' for February and March, 1881. Mr. H. Sowerby Wallis, F.M.S., there wrote as follows:—

"After the 9th of January, snow fell daily on some portions of the British Isles, and on the 12th and 13th, rather heavily over the greater part of them, so that by the 17th (on which day practically none fell) there was a considerable depth on the ground over the whole of the United Kingdom, the weather having been so cold that scarcely any had melted. This depth averaged

three to four inches over the greater part of England, and rather more in Wales, the North of England, and in Scotland. During the early morning of the 18th, the wind, which was easterly, rapidly increased in force and blew a strong easterly gale nearly all day, the wind falling again in the south at night, but in other parts of the country it lasted till about midday on the 19th. The gale was particularly severe on the east coast, but the number of wrecks and casualties all round our shores was very great; reports from many seaports stating that it was the most severe gale that had been experienced for thirty years . . . . The gale was accompanied by a heavy and steady fall of snow over all the North of England, which lasted through the whole of the 18th, and continued, although rather lighter, till about noon on the 19th. The amount of snow deposited over the whole of the southern portion of the country was very great, and was so drifted by the fierce winds, that communication both by road and rail was entirely disorganised . . . . To find anything like a parallel we must go back to 1836 or to 1814; and it would appear that in most parts of the country the depth in those years was greater, but that the drifts were not so great . . . . The loss of life in England and Wales, entirely due to the snow, was very great, and probably an estimate of 100 persons would be very near the truth."

The loss of sheep in this snowstorm was enormous, and especially on the unsheltered hills and moors. Probably the numbers lost will never be known. It was under these circumstances that the question referring to this disastrous snow-blast was included in my queries. The replies to this question do not need to be given in detail. In only two cases—those of Mr. W. A. Darbishire, in Montgomeryshire, and Lord Arthur Cecil, in Peeblesshire—did this storm result in fresh shelter being provided, and to both of these cases reference is made elsewhere. As a rule, these replies run that no loss was sustained, and that no additional shelter was required. But in most of these cases, it is also stated—and I would refer the reader to the answers to Question No. 7—that there is plenty of shelter already provided, either by stone fences, hedges, or plantations. The snowstorm was generally described as exceptional, and so not to be expected in ordinary farming. Prof. Sheldon states that in his district, the storm was not so severe as were storms on the 28th of April and on the 12th and 13th of May in the present year, when not only sheep, but not a few cattle also, were lost. He, however, does not think any additional shelter is needed, or possible, beyond the stone fences common in the bleak Peak district in which he resides. There are one or two thoughtful correspondents who allude to the great need of more shelter, while Sir J. H. Thorold states that he has a snow-plough, which is sometimes used on the grass lands to enable the sheep to get at the grass. Mr. Henry Woods says that the storm referred to strengthened his experience as to "the great advantage of protecting sheepfolds from cold winds, and giving in-lamb ewes and other sheep as much shelter as possible." Mr. John Webb writes, that "shelter was absolutely necessary,

as it saved lives, and much economised the consumption of food." Mr. A. F. Parbury describes it as a most trying time, and states that, during its continuance, sheep were put under shelter and fed artificially. In Mr. Heasman's case, the sheep were yarded and put into a dead fold formed with hurdles. Mr. R. W. Langdon states:

"I had a lot of sheep chilled at that time; and should we have another such spell of arctic weather, I should provide them with straw for bedding."

Mr. Teasdale Hutchinson put on extra hands to look after his sheep, and had them well provided with food.

Mr. John Coleman is emphatic in declaring that the lessons of the storm were that more shelter was required.

On a summary of the whole of the replies, it is impossible to avoid the conclusion that in many of our best farmed districts shelter is provided now to a great extent, and has been provided largely by our leading landowners. Still, in many districts, and notably on farms unconnected with large estates, further shelter would be very welcome. Dry food should always be kept in reserve for sheep in case of snow-blasts of severe character.

Conclusion.

In the replies given we have a series of practical experiences that cannot fail to be of great service should another such season overtake us. The reports all point, in the first place, to the overrated position of the turnip crop, and show us how disastrous at times it is to those who place entire trust in it. In the winter of 1885–6, all sorts of auxiliaries had to be called in to supply its place, and the details of how successfully they did supply that place is recorded in experience after experience. Another great lesson is taught us—that of economy on the farm. Several correspondents call attention boldly to the necessity of farmers keeping in hand a good portion of their farm produce, so as to be independent of fluctuating markets. Earl Powis and Messrs. Beauchamp and Stead both put forward this as essential to good farming, and those who had last autumn a good stock of old hay, and who tell us how they used it, do but emphasise their remarks. Another economy strongly brought out is that in feeding. The chaff-cutter is probably as great an aid to economy on the farm as any investment the tenant can go in for. With it all sorts of mixtures of food—all economic—are possible. The great value of green crops is also insisted upon—cabbage, thousand-headed kale, kohl rabi, and prickly comfrey standing out boldly in the many reports I

have received. There are a few other matters which deserve to be mentioned in separate paragraphs.

Food Mixtures.—As just stated, the great values of these were brought out prominently by the experiences of the past winter, and I am enabled to give a few special examples. Mr. William Smith, of Woolton, believes in purchasing corn largely, and this he has given in the following manner:—

"I cut all my hay into chaff by steam power, 3 tons at a time, in three hours. I steep half a bushel or more of linseed in cold water for seventy-two hours. Before use, I throw a small quantity of salt into the steep—the quantity depends upon the number of cattle and the rough of the hay used. Three tubs are in use for making the steep, one of them used daily. At 8 A.M. the cattle man, with his helper, spreads a floor of chaff sufficient for a day's consumption; he saturates the chaff with the steeped linseed, the chaff being turned as he throws the steep on, causing the chaff all to be damp alike. He puts the meal on 10 lbs. per head for two to three-years old cattle, from 4 to 6 lbs. for younger things; he turns it all over twice, so as to mix the meal well into the chaff—as that is damp, the meal sticks on; he then bags the whole up, and places it in the several sheds for use. 2 P.M. is the first feeding time; he keeps on giving it in small quantities till 5·30. They will eat no more—they are looked at again daily at 8 P.M., but never fed at that time. At 6 A.M. they are fed again, and they will keep on until 9 A.M., then they lie down till 2 P.M. One man fed (thus) 100, all ages, last winter; he has a boy to pump water that flows through underground pipes to all the cattle; another boy farms them out and litters them while they are being fed. My sheds are 30 feet in width; they contain a double row of cattle, the man feeding them from a pathway down the centre of the shed. I liked my hay last winter—it was all good; but in winters before I used a lot of rough stuff, mixing good and bad together. The cattle ate it up clean, and did well. I like good hay the best, but I can get on well with any rough stuff. I have used successfully treacle or sugar, with or without linseed. Cattle will eat a mixture of that sort and do well upon it, even if all the hay may not be good."

Mr. Gilbert Murray, of Elvaston, Derby, has sent me a detailed account of his feeding last winter:—

"The stock consisted of 40 two-year-old unregistered Shorthorn heifers, 15 Jersey cows and heifers, 30 brood mares and young horses. With the exception of the Jerseys and the four working horses the rest were wintered on old pastures without house shelter of any kind; having neither roots nor straw, and the new hay being required for the hunters, we had to fall back on a haystack two years old, much weathered and of very inferior quality, in fact except under extreme privation no stock would have eaten it in this state. The first effort was to improvise a cheap steaming apparatus; this was accomplished by placing a dome-shaped cover over an ordinary cast-iron boiler or furnace. The cover was made of zinc with a flange resting on the upper lip of the boiler, the bottom, which was open, telescoping well into the boiler. So long as the water in the boiler was above the end of the cover no waste steam could escape. Close to the boiler was constructed a brick cistern capable of containing sufficient food for one meal, in this was placed a perforated zinc bottom. A one-inch gas-pipe was brought from the top of the cone over the boiler, delivering the steam under the centre of the false bottom. The chopped hay and meal were mixed together, placed in the cistern, and the steam turned on. A close-fitting lid on the top prevented

any escape. The mixture was well soaked with cold water before the steam was turned on. The cooking occupied from three to four hours. Having peculiar advantages as to water supply, we had little difficulty in arranging a continuous feed to supply the waste going on in the boiler, the only attention required was to keep the fire going. The artificial foods used was a mixture of equal parts of pea and wheat-meal; 3 lbs. per head of the mixture for each animal per day was the allowance. This was divided into two meals, and fed in troughs in the field twice a-day. The steaming completely removed the fusty smell from the hay; it was eaten with avidity by the different kinds of stock, who were healthy and made satisfactory progress. The cost of the meal was ¾*d.* per lb., the cost of coal and labour was ¾*d.* per head per day. The forty heifers since May 1st have had 4 lbs. per head of decorticated cotton-cake per day on the pastures, which are only second rate. Cotton-cake generally is now extremely bad and probably less easily digestible than formerly. One heifer had to be killed on the 5th of July owing to persistent indigestion, terminating in inflammation. At the present level of prices it is questionable from a practical point of view whether linseed-cake is not the more economical food. These heifers were bought singly and in pairs between the 14th of November and the end of January, at the average price of 11*l.* 6*s.* 8*d.* Ten have now been sold, August 27, at an average of 19*l.* a head. Thirteen have proved in calf, most of them above an average. They dropped their calves during June and July, when such stock were practically unsaleable. The calves have been allowed to run with their dams, if placed in the yards, during the winter, and well kept. Both will be fit for the butcher by next April. The difference in value between cow- and heifer-beef in our markets is 1*d.* to 2*d.* per lb. I have long come to the conclusion that much larger quantities of roots are used in the feeding of cattle than accords with strictly economical principles.

Mr. R. W. Langdon, in Somerset, successfully carried 250 sheep through the winter, without roots, by adopting the following regimen:—

"One pint of flax or linseed to four pints of water (cold), letting it stand at least twenty-four hours. I then added two quarts of this mucilage to every two pecks of chaff and half peck of corn; this I reckon to cost 1½*d.*, whereas corn and cake costs 4½*d.*"

Mr. Charles Howard has described to me his 'slopped' food, used last winter.

"It consisted of boiled barley and 'tail' wheat thrown amongst the chaff and left for a few hours, a little linseed and cotton-cake being then added. My sheep during the past winter were fed upon linseed- and cotton-cake, beans, barley, malt, and a little wheat. Fattening animals would get from 1 lb. to 1½ lb., and breeding animals from ½ lb. to ¾ lb. daily."

Mr. George M. Ripwell, farm manager to the Duke of Bedford, also gave his sheep plenty of mixed chaff, cake, and boiled corn; ewes after lambing have a few turnips in addition. The cattle had boiled corn, mixed with hay- and straw-chaff.

At the recent conference of the British Dairy Farmer's Association, an excellent paper on Winter Dairying was read by Mr. Isaac N. Edwards, of St. Albans, and in this he gave the following table of food given during the winter, each day's supply being given in equal portions, three times a day:—

Description of Food.	1885.			1886.		
	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hay Chaff	6	8	7½	9	9	3
Oat Straw Chaff	6	8	7½	9	9	9
Crushed Linseed	1	1	1¼	0½	1	1
Crushed Oats	1	1	1½	1	1½	1½
Bran	1	1	1¼	1	2	2
Rice Meal..	1	1	1	0½	0½	0½
Wheat Meal	1	1	0¾	1	..	..
Grains	7	7	10	10	5	5
*Cabbage	14	14	20	14	..	..
Malt Dust	..	..	0¼	0¼	0¼	0¼
Eg. Beans..	..	..	..	0½	0½	0½
Maize Meal	..	..	..	0½	0½	0½
Potatoes	..	..	..	..	10	..
Silage	..	..	..	..	..	14
Total	38	42	51	47¼	39¾	37¼
Estimated Dry Matter	17¾	21¼	22½	23¾	24½	21
	s. d.	*s. d.*	*s. d.*	*s. d.*	*s. d.*	*s. d.*
Value of Food per Week	5 10	6 8	7 0	7 0	7 1	6 9

* The Cabbage was given at 3 P.M. by itself.

Average amount of food, exclusive of boiling water—42½ lbs.
Estimated average of dry matter—21 lbs. 12 ozs.
Average weekly cost of food per cow—6*s.* 8½*d.*

Besides these, both brewers' grains and silage were given largely in mixtures, and in every case with economy. I saw a good example of this in the feeding of a very large head of dairy-stock by Mr. G. M. Allender, at his seven dairy and mixed farms near Horsham, Sussex. Both these foods are here largely used, the silage being made on the stack system, and from the headland and hedgerow cuttings, mixed with lucerne, vetches, and clovers.

Silage.—The reader of the various replies on the question of Silage will be struck with one fact, which is most curious. There are many who have had no experience of this new food; but no single one of those who have kindly replied to my queries, and who have tried the system, are found to condemn it. Mr. de Laune, who has had a large experience with the silo, sums up the whole lesson of the winter by saying that it teaches us to "make more silage, and feed it with chaffed straw." I cannot say more on the question than this—all who have used it declare that without it they could not have gone through last winter as they did. Mr. Scarth's experience of sweet silage, made with the Johnson's patent stack system, may also be referred

to as showing how experience supports the award of the Society's silver medal to that system at Norwich.

Brewers' Grains.—In the West of England, especially, there are many men who have not found the need of ensilage, but these men have for years adopted a system that is practically the same. This is the storage in summer of brewers' grains; and I have a capital experience on this point from Mr. W. B. Beauchamp, of Norton Hall, Bath. This gentleman—who is a large colliery proprietor, but the son of a tenant-farmer, and one who has nearly all his life been engaged in farming also—has a farm of some 200 acres in extent, chiefly of the best description of pasturage. Only six acres are not in grass, and he has done without roots for some years. The position of affairs there last winter is shown at the commencement of the following statement which has been sent me:—

"Mr. Beauchamp recollects no parallel to the latter part of last summer since a similar season in 1844. The latter part of the summer the pastures were bare, but not so much from want of rain as from the peculiar state of the atmosphere. Dry scorching east winds killed all vegetation, the result being that there were no late grasses, and the winter feeding of cattle had to be commenced in September—two months earlier than usual. Thus, before the ordinary time of feeding, quite one-third of the usual quantity of food in an ordinary season had been already consumed. Besides this, the farm was very much overstocked, there being just over 100 head of cattle, besides 130 head of sheep and 6 horses. Fifty head of the cattle form the dairy herd, the rest being grazing steers. In the autumn, prices of cattle and sheep were very low, and nothing could be sold except at an immense sacrifice. Mr. Beauchamp looked the difficulties square in the face, and decided not to sell, but to winter the whole of the stock. How was the difficulty faced? There were no roots whatever on the farm; but this (which in many cases would have been an insurmountable difficulty) was very easily got over. Let us see what was the food supply on the farm. The hay crop of 1885 was not quite an average one, but there were one or two good exceptions on this farm. It must not be forgotten that there was in the spring a period of about six weeks during which time the grass grew rapidly. On one piece of 14 acres, which was fed as bare as possible to the middle of May, a crop of over 30 tons, of very fine quality, was cut and made in the first week of July. In the stackyard there were a little over 100 tons of hay in all, and this was made the basis of the calculation as to how to feed the stock in the winter. Then there were 2000 bushels of brewers' grains—the experience of many years having shown these to be a very valuable and cheap food for mixing with other materials. For years past these have been stored in the summer for winter use. In one of the farm buildings are two immense brewery vats, which were bought several years ago. There is a contract with a neighbouring brewery to take these grains during the summer and to the end of September, at 2*d.* per bushel. There is thus a great economy in buying in the summer. In the neighbourhood of Frome last winter they were eagerly bought up at 5*d.* and 6*d.* per bushel, and at the latter price the demand could not be met. On this farm they have become so integral a portion of the feeding system, that the need which silage meets in other cases has not been found here, the result being that, although the owner is a man of no enterprise, no silo has been built. But without either these grains or a supply of silage the achievement of the

past winter would have been impossible. When the grains are stored in the summer, a large quantity of salt is mixed with them. Besides the supply being obtained cheaper in the summer than in the winter, Mr. Beauchamp, after several years' experience, is firmly convinced that the storing of the grains greatly improves them, making them more digestible, besides adding to their flavour and palatableness for stock. The grains are put into these vats with one cwt. of salt to each 100 bushels. They are trodden down in order to get as many as possible in.

"Besides the hay and grains, an opportunity presented itself of buying 20 tons of very good barley straw at 2*l.* per ton, which was embraced. Then there were 6 acres of wheat, the produce of which was not a fine sample, but the crop was a heavy one. This had been offered in the market; but, as the highest offer for it was 14*s.* a sack, Mr. Beauchamp refused to sell, and it was kept on the farm for consumption by stock. In this case the straw was used for thatching purposes, and not for feeding. There was also the produce of 5 acres of oats; but these were not used, as the owner does not believe that they should be given to horses or cattle without being crushed. If they are, they are simply wasted, as many go through the animal and are voided whole.

"These were the resources of the farm; and with them the whole of the stock on the farm, the numbers of which I have given, were successfully wintered. The wheat was made part of the food ration; it was crushed or pulverised very fine by means of a bean and oat crusher; it was a cheap food, having been offered in the market at 15*s.* a sack (30*s.* a qr.), and at this price would be worth 6*l.* a ton. Pollards cost 5*l.* 10*s.* per ton, and bran 5*l.* The crushed wheat was not only a richer food; but, when the cost of railway carriage, cartage and sack hire were added to the first cost, quite as cheap as either bran or pollards, and very little more trouble. This wheat meal was mixed with grains and hay and straw chaff, and given to the cattle twice a day. For the dairy stock, the supply for each cow for each feeding consisted of 1 lb. of wheat meal, half a shovel of grains, and hay (two-thirds) and straw-chaff (one-third) sufficient to fill a three-peck basket. The steers had very little of the wheat, but were given chaff and grains. The sheep (not a breeding flock) had only what they could pick up on the pastures, with the addition of chaff. It is to the dairy cattle, however, that I would more especially direct attention. These are fed with a three-peck basketful of the mixture per cow twice a day; once at 6 A.M. and again between 5 and 6 o'clock in the evening. Two hours after the morning's (and also after the evening's) feeding the lads go round the cribs, and if there is any food left it is taken away, and the cribs cleaned. This is regarded as a very essential feature of the feeding system on this farm—*i.e.* that the stock should never have a surplus of food left about to breathe upon, or for the saliva to fall out upon. For a certain part of the day and night the crib is thus left absolutely empty. It is found by this system that the cattle eat more than they would if they were allowed an unlimited supply to 'mess with, and spoil, and so waste,' as it was effectively put. The system also gives a good indication twice a day as to the health of the stock, as it is at once seen if any of the animals are unwell, and so off their feed. Immediately after they have got into regular habits, it is known how much each eats, and when the supply is regulated accordingly, it is generally found that the cribs are licked out clean. It should be added that a small lump of rock salt is kept all the time in every crib.

"In this system of feeding the great value of all food being properly prepared, and of the economy which results therefrom, is insisted on. In Mr. Beauchamp's opinion, all hay or straw ought to be chaffed before being given to the animals. He has tested the matter over and over again, a week at a

time, and he is convinced that, without reckoning the waste for giving hay whole, there is a saving of quite 20 per cent. He believes that a larger proportion is assimilated by the animal when put in the crib in a convenient form, while he is certain that there is far less waste. The stock also do far better. I had many facts given me on these points; and even the labourers insist on it, though the chaffing gives them a little extra trouble. But it must not be supposed that chaffing, under ordinary circumstances, gives no trouble. Here, however, the occupier being the owner, the buildings and yards are arranged for convenience, and the chaffing is not so very much trouble after all. The system of watering stock on this farm deserves a full notice. It is done by means of iron troughs placed in the centre of the cribs, one trough for each two cattle. These are 2 ft. by 13 in. by 11 in., the trough thus taking up 13 in. of the crib. The divisions between the cribs are 7 ft. 6 in., which gives ample room for two cows. The divisions run 3 ft. back. On each side of the trough is a crib. All the troughs are on a level, and are supplied from a large cistern on the top of the buildings, which forms the source of the water supply for the house, the dairy, and the farm generally. The supply goes first into a trough in the centre of the buildings, which is on a level with all the other troughs, and the supply is shut off when the troughs are full by means of a ball-cock. There are two taps just where the water is here admitted, and these can be used so as to shut off the water entirely, to prevent its going into the centre cistern, or to flush the whole of the supply pipes to the shippon. At each end of the shippon are taps which allow of this flushing. The troughs are supplied from the ground, and a cock in any one of the troughs will cut off the supply to that trough.

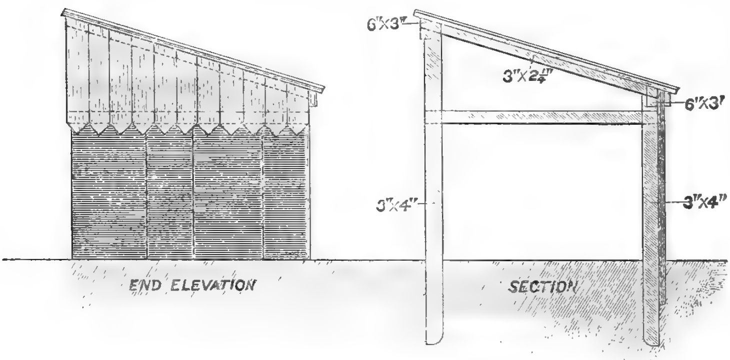
"The labour for the whole of this work is supplied by two lads; one receives 4*s*. 6*d*. per week, and the other 12*s*. There is a 3-h.p. engine (one of Hindley's), and one of Tangye's special steam pumps. With these the lad, at 4*s*. 6*d*. per week, crushes all the corn, cuts all the chaff, and pumps all the water (from a well 20 ft. deep to a tank holding 1000 gallons on the top of the buildings) for the house, farm, and dairy, besides helping in the feeding and in cleaning the cribs. This is for the 50 dairy cows; but very little help is given him for the other animals, the chaff for which has to be cut. The animals are bedded with sawdust, and it is found that this is a good vehicle for absorbing the urine and excreta, and for conveying this manure to the fields. So far as the weather permits, the manure is carried to the field daily, and there spread."

This system of keeping stock in winter by means of brewers' grains is one that is more or less practised in my own neighbourhood; but the economy of buying in the summer and storing for winter is not nearly so common as it should be. Last winter there was a great rush for them at the breweries, and I am told that 8*d*. per bushel was common, while in the summer they are a drug. Several cheese-makers go in for small quantities (about 500 bushels) in the summer, but I know of no other farm where they form so integral a portion of farm economy as here. In the North, and around the Burton breweries, I hear that they are a great drug. They ought not to be so, for by their use the want which ensilage meets in many districts has been successfully met in other districts.

Shelter for Sheep.—Generally speaking, the reports all tend to show that shelter is absolutely needed for sheep in the winter. My correspondents are all first-class farmers, and it is

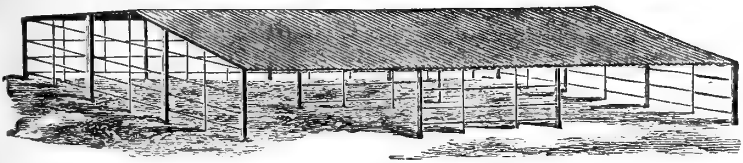
to be observed that the bulk of them speak of having shelter, and of its being sufficient. A few have planted or erected fresh shelter, and some—Mr. Henry Woods, Mr. John Coleman, and Mr. W. A. Darbishire especially—speak strongly of the greater need in this matter. The latter gentleman has recently erected three shelters in North Wales, although it is not customary to do so in the district, and he is very pleased with the result. He has kindly sent me drawings of these, which will enable any one to erect others should he desire to do so.

Fig. 1.—*Section and End-elevation of Mr. Darbishire's Shelter for Stock.*



The buildings are 30 feet long, are cheap and durable, and easily erected or removed. They are closed on three sides, the opening facing the dry quarter. The sheep and lambs have learnt to use them, and during the snow in March last they were of great service. The ewes and lambs were also taken into the covered shed and loose boxes during the March storm. "I have no hesitation in saying," writes Mr. Darbishire, "that 'shelter' pays for itself over and over again, and I shall fully equip my farm with shelter-sheds before next winter." Mr. de Laune writes that he was out in the storm of 1881, and determined to plant more shelter. "I believe," he adds, "the producing power of the country has been seriously damaged by the destruction of hedgerow timber." In the case of shelter for stock, as with silage, there is not a single condemnation from those who have used it. In the West of England a large number of portable iron sheep-shelters have been supplied by Mr. H. S. Crump, of the Alvin Iron Works, Gloucester. I give an illustration of this (Fig. 2). It is easily taken down, and re-erected; it can be made of any shape or size to order; and it is very cheap in price. A number of my correspondents recommend it, though some only use it at lambing time. In Scotland,

Fig. 2.—*Crump's Portable Sheep-Shelter.*



Lord Arthur Cecil has revived what was evidently an old experience by erecting new, and restoring old, "stells" on his Peeblesshire farm, and with advantageous results.

The Season and Crops.—In this portion of the paper the reader should be directed to the very able and exhaustive report on the drought of 1868, and its lessons, contributed by Mr. John C. Morton to the 'Journal' for 1869 (Vol. v., Second Series, Part 1). In this paper we have not only the value of drainage in a season of drought well brought out, but the questions relating to autumn and spring cultivation and of catch-cropping are well brought to the fore. On nearly the whole of the latter four questions (11, 12, 13, and 14) I am referred over and over again to the paper by Mr. Morton, and it may be said that most, if not all of the valuable lessons enunciated so powerfully in 1869, are true and germane to the last season. In fact, so little have many to say on the question that I do not here propose to give the whole of the replies, as I have done with regard to the combined questions of stock, crops, shelter, ensilage, and markets. A very short summary will give all that need be said.

There is a very strong consensus of opinion in favour of autumn cultivation. The Duke of Rutland urges, "by all means, do all you can." Mr. Henry Woods says, that "doubtless autumn cultivation is most desirable when circumstances will admit of its being done without delaying other work on the farm." Mr. Joseph Paget writes that—

"The lesson is that fallows ought to be cleaned, manured, and ploughed in the autumn, so that they have only to be harrowed and rolled in the spring, before the roots are drilled on the flat in the fine soil produced by the frost. This has been strongly enforced."

And Mr. Robert Loder also enforces the same lesson, but urges a little more. He says:—

"The past season has taught us, more clearly, how desirable and profitable it is to treat generously what is young and tender. What I have said of young stock (see answer to Question 10) may be said of young plants. Let their seed-bed be well made and manured. When they gain strength they will be able to take care of themselves, and force their roots downwards with such vigour as to defy the elements. If steam cultivation is in use, discard the steam plough. It goes too fast to keep within the range of the seed-bed. Use the lightest cultivator possible, and keep all manure as much on the surface as you can."

Other correspondents all point out how essential it is to be early with the work—economy being as valuable in tillage operations as in the treatment of stock. In Oxfordshire, Major Dashwood found that on late-ploughed lands (seeds), the wheat was much injured by the frosts, but on the broken land, such as after peas, the wheat is good and not injured by frost at all. "Cultivate as much as possible in the autumn, but the land must be dry."

Mr. Martin J. Sutton sends the following note:—

"The effect of the low temperature during the autumn was to prevent the wheat-plant getting a firm grip of the land, consequently it was lifted by the intense frost of the late winter and spring, so that the plant is a very thin one. This applies to a certain extent to the clover plant; but I think this was injured more in March than previously, for up to that time it was looking fairly well. All land cultivated in the autumn was brought to a beautiful tilth and powdery condition by the successive frosts, so that there was a particularly good seed-bed for all kinds of sowing this spring; and notwithstanding the cold ungenial weather, there will probably be fewer gappy mangold fields, and a better turnip plant than for some years, although corn can hardly recover the effects of the cold nights and want of sun."

But there are a few correspondents who have practically given up autumn cultivation. One such is Mr. Henry J. Sheldon, who gives his reasons as follows:—

"The wheat was much damaged by the frost and east winds, where the snow was blown off the land; and I have had to plough up two pieces of wheat and plant barley. As to autumn cultivation, I used to like it, but it is many years since I have had a sufficiently early harvest and dry autumn to be able to practise it."

In fact the whole experience of autumn cultivation can be summed up in the words of Mr. Charles Randell: "The effect of the past winter has been to confirm all our experience, that early sowing of all autumn crops is safest and best, especially upon heavy land, *if it can be done well*—bearing in mind that *how* it is done is of more importance than *when*." And Mr. William Stratton, writing from the light corn district of the Wiltshire Downs, is equally emphatic: "After a severe winter, it is often necessary to resow a considerable proportion of the autumn-sown area. It is still advisable to sow freely of autumn crops, notwithstanding such risk." Speaking generally, the great consensus of opinion is that even in such a season as the last, the superiority of autumn-sown crops is confirmed. Although they were late and backward in the spring, they have everywhere recovered themselves much more quickly and effectually than have the spring-sown. "The season," says Mr. John Coleman, "has been very trying for autumn-sown crops. Wheat has suffered severely on all strong, low-lying, and imperfectly drained soils. The result has been great loss of plant and consequent deficient yields. Autumn and spring

cultivation depends upon the nature of the soil and the intended crops. I do not think the past winter has altered my views. Land intended for bare fallow is best unploughed. Root land should be ploughed early when the land is dry, and, if possible, worked in spring by cultivating implements only." And Earl Powis sums up the matter in the lesson, "*Lose no opportunity when the land is fit*."

Speaking in a general way, the alterations brought about by the past winter have been slight; and as for spring catch-crops, where they are grown, they would still be relied on in ordinary seasons, though in one instance they failed to be early. Everywhere the best wheats have been produced from early sowing, but a large number of late-sown wheats were failures, and these were ploughed up, and resown with barley. This latter crop was everywhere sown late, but has generally done well, though in many districts it has suffered from wet and cold. Winter wheat in many districts has suffered from wireworm, and is thin on the ground everywhere. Mr. H. J. Sheldon may be quoted as giving his experience:—

"12. It has made no difference in my arrangements, except getting more horses in order to be able to make up for lost time, and to be able to take advantage of the few dry days one has, and get double work done in the short space of time the weather gives one to do it in, which is, of course, an increase of expense which present prices make one ill able to afford.

"13. The wheat is very late; generally too spiry in the braird, and on *strong* land the constant and heavy rains of the last three weeks have turned it yellow, as also some of the barley. On May 12 and 13 we had 3½ inches of rain, which, with constant rains ever since, have done a lot of harm to everything, and will prevent most of the corn-crops from being hoed—these three weeks being the proper time to do so, and it has been impossible to touch them."

So also says Mr. Charles Randell:—

"12. The effect has been to delay all spring sowing; for instance, last year my barley was drilled in January; the crop averaged 7½ quarters per acre. This year it was planted late in March, and will probably produce 2 quarters per acre less. This, however, is not all owing to late sowing; the cold wet weather of May and the beginning of June checked the growth of barley; it lost colour, and this had to be restored by nitrate of soda—¾ cwt. per acre.

"13. Wheat upon heavy land, more especially after steam cultivation, suffered from the soil being deeply pulverised by frost, and the impossibility of rendering it firm in the spring by rolling; it was never dry enough. Here again the late-planted suffered most."

Mr. J. H. Arkwright also says:—

"11. Autumn-sown corn crops have a distinct advantage over Lent corn. Spring crops are thin, and the straw weak and short: we like to get our wheat in by or before the 1st of November.

"12. There has been a far greater acreage of oats planted this spring in

consequence of the past season, than of wheat or barley. It does not pay to grow wheat."

Mr. Faunce de Laune may be quoted in conclusion :—

"11. I consider it advisable to plant a part of the fallows intended for winter keep with autumn-sown kale plants, to make certain of a late autumn crop to wean lambs upon.

"12. Mangold-wurzel has failed twice through being eaten by flea; the ground is now sown with kale, which did not grow until it rained. In some cases kale has had to be sown twice, and has been seriously damaged by earwigs.

"13. I grow neither barley nor wheat, but I consider the barley in this neighbourhood looks remarkably well."

In several districts winter-beans suffered very much, some fields being destroyed, and others proved very short and next to worthless; both these and peas had to be pulled up in the spring by Mr. C. Howard. In Wiltshire, Mr. James Greenaway was compelled to substitute oats for barley in many cases, and also planted more summer tares than usual, together with early rape and turnips for autumn feeding. But the general consensus of answers to Questions 12 and 13 is that no material alterations beyond those mentioned have been made, and that—beyond a tendency to substitute barley for wheat, brought about more by the state of the markets than the past season—there have been but little alterations made. In a few instances, correspondents have referred to the curious fact that the red wheats generally stood the winter better, and were hardier than the white varieties.

The last question in my series is of a somewhat open character, and some of my correspondents ran riot somewhat on questions that are, I take it, outside the scope of this enquiry. The fiscal relationship of England with other countries, and its effect upon the labourers; the lack of capital among tenants; the question of rents and of heavy taxation; the duties of tenants on the one hand, and of landlords on the other—all these may have had some relationship to the exceptionally bad times which farmers have had to go through since last summer. But this enquiry was, as I understood my commission, to be of a practical and not of a politico-economic character, and all such answers I have carefully put on one side. A few excellent answers may be well quoted from those that I retained.

Mr. Henry Woods writes:

"14. Yes; as affecting the cultivation of maize which is now annually grown here for the purpose of ensilage. The yield of green maize fodder was less than half the average of the two previous seasons, which produced 32 and 28 tons per acre respectively. I attribute the lightness of last year's crop to the cold dry weather during the early stages of growth, but I am confident that in ordinary seasons a good and remunerative yield may be relied upon."

Major Dashwood:

"14. The low price of corn and also of stock has made it very bad for any one connected with agricultural land."

Mr. John Treadwell:

"14. The better the land is farmed, the better the crops have withstood the weather. The consumption of meal instead of cake decreases the consumption of hay (there being more bulk) with our dairy cows; but I doubt, upon the whole, whether it is much cheaper than cake."

Mr. J. H. Arkwright:

"14. That all our produce is undersold by foreign production in the markets, and that it matters little if we grow good crops. We are very near the last pound on the camel's back. We observe that the men who have done best are those who, with some capital, have been able to keep their land in heart by employing labour, and not letting the land go back."

Mr. James Greenaway:

"14. There is one great point of interest I have particularly noticed, which is, that where sheep have been liberally treated, and fed on cut straw and hay with a little malt-dust, or a small quantity of cake also given, that there has been a less percentage of loss during the lambing season, and a greater security against the loss which takes place when succulent food is given in spring."

Prof. J. P. Sheldon:

"14. That the quality of the herbage on permanent grass land has improved considerably during the past two or three years, and that there are fewer 'screws' among cattle, while, as to sheep, the liver-rot has disappeared for the time being. Still it is true that the land will not carry as much stock as it formerly did, and poor land is recovering more slowly than land that has had help. The long frost of last winter has done good in lightening up the soil, and there is a prospect of improved crops of grass this year."

Earl Powis:

"14. The violent and sudden changes of the weather which we have experienced during all the past year have tended to retard the progress of feeding stock considerably, and has also been prejudicial to the health of both cattle and sheep. The heavy soaking rains and resultant floods have been very injurious to the sheep, causing a good deal of foot root; probably a good deal of fluke may result on land subject to it."

Conclusion.—The whole of the reports which have been received tend to show the great difficulties which attended the autumn, winter, and spring of 1885–86. That these difficulties were due to various causes is also apparent. The season intensified other causes, and brought them out into greater relief. The markets showed abnormally low prices—the result of the large importations of foreign corn, meat, and dairy produce; the depression in the manufacturing centres; and low freights. This had been the case for some time, and had combined with a series of bad seasons to make the tenant farmers of the country—and all, in fact, who had to do with land—short of capital. With

a failure of the root crops, and with the knowledge that to properly carry stock through the winter, or till such time as they were properly fattened, this shortness of capital was a potent factor in forcing half-fattened stock into markets already filled with meat from New Zealand, as well as places in our own hemisphere. It was in such a combination of circumstances as these that the winter of 1885 came upon us so early.

This enquiry shows, by example after example, that there was no occasion whatever for such a wholesale sacrifice of half-fattened stock as was the case in the autumn of last year, and that we still need to learn the lesson of greater economy in cattle feeding. If we did not trust so much to the turnip crop, we should not have seen the markets glutted with unfinished stock, and the great losses which followed would never have been suffered. The turnip crop is not everything in winter feeding, and its place can be filled in many ways, and that too without having resource even to the expensive cake. Silage and brewers' grains are both shown to be excellent succulent foods, while at the present low prices of both English and foreign corn, mixtures of corn meal are cheap. The whole lesson of the past winter is one of economy—to always economise, by proper mixtures and proper thrift, all the produce of the farm. If all owners of stock would have a supply of Silage, or brewers' grains, or of rough corn for crushing, of straw and hay, or of linseed, they might in a bad root year find themselves quite independent of roots for the winter which followed. In a good root year, they might increase their stock, and, by due economy of mixtures, keep a larger number. By proper food-economy a much larger head of stock than is now kept could be sustained on our present resources. But trusting to the turnip crop alone is like having all the eggs in one basket; and when the crash comes, the whole resources are gone.

In writing the above, I have not the slightest wish to dogmatise. In practical agriculture, the least that is done in that way the better. The position of a farmer with regard to the land he actually tills is very like a large number of men playing whist. No two hold the same hand, and each has to play his own hand to the best of his ability. So too, no two farmers have to deal with conditions of agriculture that are exactly alike. Their farms vary in soils, in climate, in live stock, and in resources. A collection of the best experiences during a season like the last will be of service, however, in giving the reader a good idea of how those who have revealed them have utilised their resources, and few practical men will not learn some valuable wrinkles, how they themselves can

better utilise the resources on their own farms. In this way, I believe that the valuable experiences recorded in the preceding pages will be of great value to the country. No one can read the valuable reports of Mr. Henry Woods, Mr. Charles Randell, Mr. A. F. Parbury, or Mr. Beauchamp, without being struck with the admirable way in which these gentlemen successfully (and with only the use of ordinary intelligence) met a difficult time.

Another lesson is the great value of silage, or that which is really its equivalent, brewers' grains.

The value of shelter is another matter that deserves attention. That in many parts of England and Wales there is a good deal provided by the hedgerows and plantations is certain, but in many of the more exposed places additional shelter might be economically adopted. It must not be forgotten that proper shelter, provided once for all, means an economy in food in perpetuity. Where the animal is exposed to the winter's blast, food becomes merely fuel to maintain vital heat. It is an expensive way of using food, and on this ground alone—to say nothing of the humane view of the matter—there is much to be urged on behalf of proper shelter.

Turning to the question of corn crops, and that of autumn or spring cultivation, the season has not brought out many striking lessons. The Agricultural Returns for the year show that wheat has declined 7·8 per cent. since last year, and barley 0·7 per cent., while oats have increased 4·8 per cent. The decrease in wheat is about the same as between 1884 and 1885, but during that period barley showed an increase of 4·6 per cent. That part of the decline in wheat was due this year to the season is certain, but much of it was due to the lowness of prices in the market. The effect of the late seed-time in the spring was to check the sowing of barley, and to cause oats to be substituted. But for this fact the Returns would this year have shown a large increase in the area under barley, but its place is taken instead by oats. Between 1884 and 1885 this increased 0·9 per cent., but this season the increase is 4·8 per cent. These figures bear out the majority of the Returns, that but little change in cropping of white crops resulted from the winter weather of 1885–86.

Autumn cultivation also is well spoken of by all correspondents. But here all depends on the season, and on the fitness of the land. Cultivation should be as early as the condition of the land and season will allow.

During the spring, green catch-crops were everywhere late. Some pieces of cabbage, thousand-headed kale, and other such crops came on late, and were of great value. In no single case has a correspondent announced his intention of altering his cropping for other seasons because of the failure in this matter last

winter. These crops are found to be valuable, and well worth running some amount of risk to obtain.

In conclusion, I should like to express my thanks to the many correspondents who have so kindly responded to my enquiry. The great bulk I have been unable to use; but I have read them through carefully, and I do not think any salient point has been omitted, but that each is noted in one or other of the selected replies.

XVI.—*Abortion in Cows:—An Inquiry into several local Outbreaks of this Affection, occurring in the neighbourhood of Kirkby Overblow, Yorkshire.* By C. J. B. Johnson, L.R.C.P., &c.

This malady has been prevalent to a greater or less degree in this neighbourhood for generations, at times to such an extent as to ruin some stockowners, and very seriously inconvenience many. My enquiries commenced about twelve months ago, and include, so far as I know, all cases, except a few arising from injuries, which have occurred within four miles of my house during the past seven or eight years, and a few beyond that distance.

I have said "so far as I know," because I have frequently found a disinclination on the part of the unfortunate farmer to admit that such an occurrence had taken place amongst his herd; from the fact that in this neighbourhood it is universally considered to be an *infectious* disease when two or more cows abort in quick succession without known injuries. In the vernacular it is designated "Pick," or "Right Pick."

Should there be a considerable interval between the cases, it is not considered infectious, and is designated "not the right Pick." The latter is regarded as being in the ordinary course of events; but the former is greatly dreaded, as it is popularly supposed to hang about the farm for three years, and then as mysteriously to take its departure as it had its entrance. For, with very few exceptions, the source from which the first of each herd was supposed to be infected was totally unknown. Neither could a reason be assigned for its final departure beyond that of its allotted time.

My attention was first particularly drawn to this subject by seeing a cow which had recently aborted. I asked the owner, a very intelligent man, the cause of it; he replied, "he supposed it was smittle" (Yorkshire for infection), as he had had over twenty similarly affected animals during the past year. I said

I did not know much about cattle, but that we had no similarly infectious disease in the human subject; and that as he was a member of the Royal Agricultural Society, I should advise him to send a sample of his hay to their Botanist for examination, as it might be caused by a fungoid growth named Ergot, which attacked grasses as well as our food-cereals.

Unfortunately at that time I was practically unacquainted with the appearance of ergot in its growing state, though I was quite familiar with the mature specimens used in medicine, which are gathered from the cereal rye.

I saw no more of this gentlemen, Mr. H., for some months. When we next met, he told me he thought I was right in my view of the cause of the abortions. I asked him if he had sent his hay to be examined, and found he had not; but that he had seriously considered what I had previously said on the subject, *and had* determined to test the hay himself, which he did by withholding his own hay from the cows and substituting purchased hay. From that time, and without any other known change in their surroundings or food, his remaining in-calvers carried their calves to the full period of gestation.

This apparent success led me to make further enquiries, and I soon found what a terrible scourge this malady had been to farmers in this district, and how little it was understood by them.

I considered some of my spare time would not be ill spent in collecting all the obtainable information respecting this malady from those whose herds had been affected by it. With this end in view, I drew up a number of questions which I put systematically to my informants, the answers to which I duly entered in my notebook. These questions have been added to as experience has suggested.

About this time I read an article on this subject in the Society's 'Journal,'* in which the writer considered that bad water and bulls were frequent contributors to this malady. He also "believes that ergot is often innocently blamed—and further, that instead of being a frequent cause of abortion, it is an exceedingly rare one."

I therefore made especial enquiries as to the merits of these three possible agents in the production of this malady, as well as the locally universally assigned cause, viz., infection.

As a guide to my readers in perusing the frequently long and, I am afraid, somewhat tedious histories of the local outbreaks, I will briefly state that my experience is quite at

* Second Series, vol. xxi., pp. 502 *et seq.*

variance with that of the before-mentioned writer in the three agents named, as it is with the public generally as regards infection.

The water in this district is almost universally obtained from streams (which have not been polluted) and springs; the stagnant odoriferous ponds of some parts being practically unknown here.

The bulls will, I think, be exonerated after reading the several cases I have recorded.

Whilst ergot has not been "innocently blamed," in this district at least, from the simple fact that none of my informants ever heard of it previous to my enquiries, though a few, when shown their grasses infested with it, remarked they had seen it, but did not know what it was.

Of infection I shall have plenty to say further on, merely remarking that I shall give equal prominence to all circumstances which appeared to favour that theory, as to the reverse.

I will now give extracts of my notes of each local outbreak, in the order they have been taken, not as they actually occurred. Wherever the term "shed" is used in this article, it is intended to mean a building in which cows are kept; "stalls," represent the compartments in the shed, in which are usually two cows, the partitions being about 4 feet in height and 6 in length; "stand," refers to the place in which each animal is fastened.

Farm 1.—Mr. T. H.'s. In 1883 kept about 26 milking-cows, but has since gradually given up the milking business.

In May of that year he turned out six in-calvers into a field, not in his own occupation, about a mile and a half from his farm.

No abortions having previously taken place (so far as known), either on his farm or in this field, nor were there at that time any in the immediate neighbourhood.

The first week in July one of the six aborted (about 7 months gone), a fortnight later a second did so, at about 8 months; and finally five of them were similarly affected. The first three cases were immediately isolated by removal to a shed for some days, and then to a pasture, both being some distance from his main herd. The two later cases were not removed, but remained with the one which went her full time.

Early in August one of the cows kept at home aborted, and from that time till the first week in May, 1884, no cow carried her calf the full period; about 20 in all aborted, a few when out, but the majority when kept up. Isolation was attempted at first, but afterwards became impracticable.

The first week in May he substituted purchased hay for his own and gave it to his cows. From that time, and without any other known change in their food or surroundings, his remaining in-calvers carried their calves to the full period, in company with those that had aborted.

In the autumn of 1885 I examined Mr. H.'s pastures and found ergot in all of them, especially so in a four-acre field, the most recently sown down; this field was mown in 1882 or 1883, late, the hay from which might have been a contributor to the severe loss of 1883 and 1884. These cows were served by

three bulls belonging to different owners, none of whom had other cows abort.

From May 1884 to Dec. 1885 all the cows went their full time. At the latter date Mr. H. had reduced his milking stock to four, which were in one shed, as under:—

On Dec. 17th, an Alderney aborted after three weeks' premonitory symptoms.

On Jan. 5th, 1886, the cow standing next to her aborted. I then advised that the remaining two should not be turned out for the usual hour or two's grazing, knowing ergot to be present in the pasture; they went their full time. Total number of abortions, 29.

PLAN of MR. T. H.'s SHED, taken January 7, 1886.

7.	6.	5.	4.	3.	2.	1.
Ieifer fattening.	In-calf heifer, due in May. Calved in May at full time. Not allowed out after Jan. 5.	Empty. Two in-calvers, sold in Oct. just at calving, stood here previously. They went their full time.	Empty.	Cow in-calf due late in Jan. Calved at full time, Jan. 31, 1886. Not allowed out after Jan. 5.	Alderney aborted at 7 months on Dec. 17, 1885. Premonitory symptoms 3 weeks. Calf putrid. Not removed.	Cow aborted at 7 months on Jan. 5, 1886. Premonitory symptoms 3 days, Calf dead, but fresh. Not removed.
7.	6.	5.	4.	3.	2.	1.

Farm 2.—Mr. S. B. keeps about 12 milch cows. In June or July 1882, one aborted, two more did likewise at intervals during 1883 and 1884; they were *not* separated from the rest of the herd.

He makes a rule of taking his cows up the week after Martinmas; they are not allowed out again except to drink (in the yard) till late in spring.

In Dec. 1884, a few weeks after being taken up, a cow aborted. From that time till the end of March, 1885, none calved at their full time, eight in the meantime casting their calves from half time up to within six weeks of the full period.

The first week in April, all his hay being consumed, he purchased some. From that time the abortions ceased, his remaining three in-calvers carried their calves the full period, and brought forth living healthy calves; no change whatever being made in their food or surroundings, except the forced substitution of purchased hay. Two calved before being turned out with animals which had aborted on either side of them, and the third soon after being turned out.

This case well illustrates how absolutely and exclusively the belief in the infectiousness of this malady is held by the farmers of this district. For, on putting the usual question to him *after* he had stated the above facts, "What do you consider to be the cause of this malady?" his reply was "smittle" (infection).

Ergot was found abundantly in the pastures, and some of his own hay was made very late. Used his own bull for all his cows, which also served a few other cows, none of which aborted.

On Dec. 12th, 1885, a cow unknown to be in-calf, which was being fattened, aborted at about half time. I took a plan of the shed in Jan. 1886, to more accurately mark the progress of the malady; but fortunately it has made no further progress. Seven of the aborting animals, and two which went their full time, were in this shed in the winter of 1884 and 1885. Mr. B. is unable to give the exact positions of the latter, though he is sure they were not standing next to each other.

PLAN of MR. B.'s SHED, taken January 9, 1886.

9.	8.	7.	6.	5.	4.	3.	2.	1.
Calved at full time in Nov. 1885.	Calved at full time, in Nov. 1885.	Due in May. Calved at full time.	Geld.	Due in April. Calved at full time.	Due in April. Calved at full time.	Due in Jan. Calved at full time, Jan. 27.	Cow fattening. Aborted at about half time, Dec. 12, 1885, probably from injury. Had not been out for 2 months. Not removed.	Calved at full time, Nov. 1885.
9.	8.	7.	6.	5.	4.	3.	2.	1.

Farm 3.—Mr. R. B., in 1883, kept about 26 milch cows, and dealt in them. He is now reducing his stock, from the heavy loss sustained by this affection and the low price of milk.

He took his cows up in the middle of Oct. 1883, and fed them on oat-straw and other food till Dec., when his straw ran short; and as he did not want to thresh just then, he substituted hay for it. In the course of about ten days after this change three cows aborted in one shed, two of them standing next each other, six in-calvers (which all went their full time) being between them and the third.

He then threshed and gave straw; whilst consuming it no further abortion took place. On again using hay, the abortions recommenced; two cases taking place in a second shed, two cows being between them, and another aborting in a third shed.

Mr. B. thinks these intermissions, in conjunction with the administration of straw, took place on three occasions. He was not intentionally trying an experiment, as he *then* had no doubt the malady was infectious, and thus he did not notice the coincidence at the time. That his memory is likely to be correct may be inferred from the fact that between Dec. 1883 and June 1884, he had thirty cows abort. A labourer's cow which grazed with these in 1883 and 1884, but was housed at home (consequently not partaking of the same hay) went her full time.

Isolation was attempted at first, but became impracticable later on. The cows were served by two bulls, both belonging to Mr. B., each of which had some cows abort, and some go their full time. In Nov. 1883, I bought from Mr. B. six supposed in-calf heifers served by the younger bull; one turned out barren, the remaining five brought forth full-timed healthy calves in the spring.

From June 1884 to Feb. 1885, all or nearly all Mr. B.'s cows went their full time; in the latter month six in-calvers were in one shed, one aborted and was *not* removed, the other five going their full time. So far as is remembered no further loss was sustained from this cause till Sept., when a cow which had previously aborted, again did so whilst out at grass.

Six or seven years since, 28 acres were sown down to permanent pasture, which has been annually mown and converted into hay up to 1884, since then part of it has been pastured, in which last autumn I found ergot. These seed fields were allowed to stand till the rest of the haymaking was completed, with the idea of allowing the seeds to ripen and drop on the ground.

It was this late-made hay on which the animals were fed, alternately with straw, in the winter of 1883–4, when the abortions commenced and inter-

mitted in the manner already mentioned. Ergot was found in all the pastures near home, especially and most abundantly in the best pasture.

Such was the history communicated to me in Sept. 1885, when we examined the pastures. I then requested Mr. B. to make a note of the important points in connection with any subsequent abortions which might occur, and to let me know when such an event took place. In Jan. 1886 I took plans of all his sheds, noting the condition of each animal with respect to her period of gestation, &c. I gave a copy of these plans to Mr. B., and requested him to fill in each delivery, whether premature or not, and such other particulars as he considered important. This he has done.

He has five sheds at home, and an old barn some 300 yards distant fitted up for 18 animals, in which are kept heifers and cows not in-milk. No. 5 shed has lately been used—for isolation purposes. I give plans of Nos. 1, 2, 3, and 5 sheds (pp. 448, 449). No. 4 I do not give, as this year it contained only one in-calver, which has calved at full time.

I reluctantly withhold the plan of his barn-shed, as it is unreliable for the purpose of ascertaining the influence of infection; from the fact that though each animal had an allotted stand, and *usually* occupied it, they were not strictly restricted to such allotted stands. For example, if on returning from grazing, No. 1 entered No. 6 stand, she was allowed to remain there for the night.

I have the plan before me, with the positions which the animals usually occupied; no part appears to have acted as a special nidus for the disease. It is a great pity such laxity was allowed in this shed, as most of the animals mentioned below resided here for a longer or shorter period.

Mr. B., in 1885, after the regular haymaking was over, mowed the most luxuriant parts of the pasture adjoining the barn, and converted it into hay. This, with other hay, was placed in the loft of the barn, and was during the winter given to the animals residing there. On two occasions I examined this hay, but failed to find ergot; yet some of the spikes had a very suspicious appearance, and on wetting a spikelet from such with a drop of water, and placing the latter under the microscope, conidia, much, but not exactly, like those found on the growing ergot, were visible.

Mr. B. has recently told me he found ergot in the above-mentioned barn pasture in Oct. and Nov. 1885. So that though I did not succeed in finding specimens of undoubted ergot in this hay, I think it probable ergot was present, though so small as not to project beyond the pales.

The animals in the barn were turned out to graze the greater part of each day during winter, and were frequently in the barn pasture; so that they had a probable chance of partaking of ergot in the hay whilst in, and a certain opportunity of picking it up whilst out at grass.

The cows at home were also turned out daily, but only for an hour or so.

I will now give the cases as they have occurred since Sept. 1885.

In No. 2 shed, 7 and 8 stands, were two cows, which had been served by the same bull within a few days of each other. The one in No. 8 stand aborted late in Oct., and was not removed; her companion of the *same stall* remained healthy, and calved at her full time, Dec. 24.

Nov. 26, a cow (*b*) in No. 3 shed, No. 6 stand, showed symptoms of aborting. She was removed that day to No. 5 shed, No. 3 stand, and aborted the following day, Nov. 27. On Dec. 1st a heifer was brought from the barn to No. 3 shed, No. 6 stand (*c*) (the one in which the previous animal had been), to fatten; she was here fed on straw, turnips, meal, and cake (no hay or water). On Dec. 26 she aborted, and was removed on Dec. 27 to No. 5 shed, No. 1 stand. These two cases succeeding each other from the same stand would seem to point directly to infection as the cause. They are certainly the most suspicious of any I have met with. But mark the

Plans of Mr. R. B.'s Nos. 1, 2, 3, and 5 Sheds, taken January 7, 1886.

(The animals marked (a), and those without letters, were in the Sheds on the above date.)

No. 1 Shed.

9.	8.	7.	6.	5.	4.	3.	2.	1.
Here 12 mths.; due in Mar. Calved Mar. 27. Sold April 8.	Here 12 mths.; due March 29. Calved at full time and sold.	Here three weeks, and is now due. Calved Jan. 19.	Due March 4. Has been here 12 months. Calved Mar. 11. Sold.	(*a*) Came here to-day just at calving. Calved Jan. 10. Sold Jan. 15. (*b*) Came on the 18th Jan. Calved on 19th. Sold Jan. 25. (*c*) Brought from Barn, No. 1 Stand, Feb. 7, due on the 19th. Calved all right and sold. (*d*) Bought from Mrs. W., due to calve to-day, Feb. 23. Calved, and sold March 1.	(*a*) Geld. Sold fat. (*b*) Due in Sept.	(*a*) Due on Jan. 11, has been here 12 months. Calved Jan. 10, 1886. Sold on the 15th. (*b*) Came Jan. 18. Calved on 19th (full time). Sold Jan. 22. (*c*) Jan. 22, brought a heifer from Barn, No. 18 Stand, due Feb. 15, calved Feb. 16.	Aborted Jan. 1, 1886, about 4 months off. Not removed. Has been here 8 months.	(*a*) Calved at full time, Nov. 9, 1885. Sold. (*b*) Due in Dec. 1886.
9.	8.	7.	6.	5.	4.	3.	2.	1.

No. 2 Shed.

10.	9.	8.	7.	6.	5.	4.	3.	2.	1.
Due in March. Here 6 months. Calved April 1, full time. Sold April 8.	Due July 18; has been here 12 mths. Cast her calf five weeks before her time on June 2, 1886.	(*a*) Calved in Nov. (*b*) The cow previously in this stand aborted in Oct. Was not removed for 3 weeks, then sold. Nos. 7 & 8 were both served by same bull within a few days of each other.	Calved Dec. 24, at full time. Had been here 12 months.	(*a*) Has been here 12 months, is due April 29. On Feb. 1 slipped down, on the 10th showed symptoms of aborting; was that day removed to No. 5 Shed, No. 2 Stand, and aborted the following day. (*b*) Feb. 23, cow from Mrs. W., just due. Calved March 1. Sold. (*c*) Brought cow from Barn, No. 3 Stand, March 15. Calved on the 22nd, at full time. Sold.	Calving Here one week. Calved twins, and has since been served.	Calved at full time in Nov. 1885.	Geld. Sold fat.	Has been here since May 1885. Is due May 4. Aborted April 4 and sold on the 16th, remaining here in the meantime.	Has been here since April 15, 1885. Is due April 15. Calved April 14. Sold.
10.	9.	8.	7.	6.	5.	4.	3.	2.	1.

7.	6	5.	4.	3.	2.	1.
(a) Geld heifer removed Jan. 19 to No. 4 Shed, No. 2 Stand. (b) The cow which originally stood here, due to calve Jan. 28, 1886, was removed (being dry) to the Barn, No. 11 Stand, on Dec. 9, 1885. She returned here on Jan. 19, calved on the 28th, and sold Feb. 1. (c) Cow from T.'s calved and sold. (d) Cow from S.'s calved Feb. 19. Sold. (e) Cow from T.'s came March 3. Calved at full time, April 12. Sold April 16.	(a) Geld heifer. (b) The cow which aborted Nov. 27 stood here. She was removed to No. 5 Shed, No. 3 Stand, the day previous to aborting. (c) On Dec. 1, 1885, a heifer was brought from Barn to fatten. Fed on straw, turnips, meal and cake (no hay or water). She aborted here on Dec. 26, about five months gone. Was removed to No. 5 Shed, No. 1 Stand, on Dec. 27. (d) Fat heifer sold Feb. 22. Brought the cow (b) back from No. 5 Shed, No. 3 Stand, Feb. 23.	Came just at calving in Oct. Sold fat.	Came just at calving in Oct., is now fattening. Sold fat.	Came just at calving in Sept. 1885. Served again in Nov.	In June 1885, calved a little before her time, is now due May 15, 1886. Calved May 16, sold.	(a) Aborted at Barn, No. 8 Stand, Dec. 31, 1885. Brought here Jan. 2, sold Jan. 8. (b) Cow from Mr. H.'s just at calving. Calved all right. Sold Feb. 5. (c) Cow from P., came just at calving. Calved; sold Feb. 10.
7.	6.	5.	4.	3.	2.	1.

No. 5 Shed.

6.	5.	4.	3.	2.	1.
Feeding. Sold Feb. 4.	Feeding. Sold Feb. 6.	Feeding. Sold Feb. 23.	Removed from No. 3 Shed, No. 6 Stand, Nov. 26, 1885, with symptoms of abortion. She aborted here Nov. 27. Feb. 23, 1886, was removed back to her original No. 6 Stand, No. 3 Shed.	(a) Aborted in Feb. 1885, is now due to calve in Feb. 1886, has been here two years. Sold Jan. 25. Calved the first week in Feb. a full-timed, living, healthy calf. This is the animal especially referred to as having every opportunity of obtaining infection—if such there be—from her right and left neighbours. It was also in this stall she aborted in 1885. (b) Cow from T.'s just at calving, calved and sold. (c) Feb. 10, cow removed from No. 2 Shed, No. 6 Stand, with symptoms of abortion. Aborted Feb. 11. Sold Feb. 18, 1886. (d) April 24, Heifer which had aborted at the barn this morning moved here.	(a) Heifer aborted in No. 3 Shed, No. 6 Stand, on Dec. 26, 1885; was moved here Dec. 27, and remained here till March 1, 1886, when she was removed to No. 4 Shed, No. 4 Stand, to fatten. (b) March 20, heifer from Barn, No. 5 Stand, being about to abort, was moved here. Aborted on the 21st.
6.	5.	4.	3.	2.	1.

succeeding part of their history. They were both removed to No. 5 shed, to Nos. 3 and 1 stands respectively.

Here again Mr. B. was trying a very interesting though unintentional experiment, for in No. 2 stand, that is, between these two cows, one of which had actually aborted in this shed, and the other the day previous to her arrival, was a cow that had aborted in Feb. 1885, and which Mr. B. had forgotten was due to calve in Feb. 1886. If any cow ever had a fair opportunity of being infected, this one had; but she remained perfectly healthy, and was sold on Jan. 25th within a few days of calving. I afterwards ascertained that she calved a healthy full-timed calf during the first week in February.

As tending to show that the above two abortions which at first sight have so much the appearance of being due to an infectious agency, were not likely to be really due to such, I may point out that the in-calver in the same stall (*b*) (No. 7 stand, *vide* Plan 3, p. 449) remained there perfectly healthy till Dec. 9, and eventually returned there, and calved at the full time.

The cause of the abortion in the second animal remains unknown. It might have been from ergotised hay or grass consumed previously to its arrival in this shed. Or whether keeping a pregnant animal without water (except that contained in turnips) would predispose to this malady, I am unable from experience to say, though theoretically I should expect it would do so.

On Dec. 1st a cow (being dry) was removed from No. 3 shed, No. 1 stand, to the barn-shed, No. 8 stand; she aborted Dec. 31st.

Jan. 1*st*, 1885.—A cow aborted in No. 1 shed, No. 2 stand; she was not removed, and the cow next to her calved at her full time Jan. 10th.

Feb. 10*th*.—A cow in No. 2 shed, No. 6 stand, which had slipped down on Feb. 1st, showed symptoms of aborting; was removed to No. 5 shed, No. 2 stand, and aborted Feb. 11th.

March 20*th*.—A heifer in the barn-shed showed symptoms of aborting; was removed to No. 5 shed, No. 1 stand, and aborted March 21st.

April 4*th*.—A cow in No. shed, No. 2 stand, due May 4th, aborted; her companion in the same stall calving at her full time, April 27th.

April 24*th*.—Heifer in barn-shed, No. 4 stand, aborted; removed same day to No. 5 shed, No. 2 stand.

On the above date the remaining eleven in-calf heifers were turned out (night and day) into the ridge fields, where no ergot was found. They remained there till June, no abortions in the meantime taking place; they were then brought back to the home pastures.

June 12*th*.—Cow in No. 2 shed, stand No. 9, cast a living calf about five weeks before her time; it lived, and, the note says, was sold July 6th for 10*s*. 6*d*.

July 7*th*.—One of the above heifers cast her calf apparently about three weeks before her time. Four of them have since calved at full time. I find a note to the effect that an ewe aborted on the 15th of Feb. and was not removed from her companions.

Total number, 50.

Mr. B. had a heifer abort on August 18th; she was turned with his dairy cows on the 21st, and remained with them till the 30th when she was sold.

September 2nd, a cow suckling a foster-calf aborted in the "Spring fields;" she was taken up immediately. On the 17th, another aborted in the same pasture; she also had a calf running with her.

I examined "Springfields," but probably from the bareness of the pastures I found only a small quantity of ergot, as I know they contained a large quantity last year.

Farm 4.—Mr. D. B.'s. Mr. D. B. keeps about 13 milking-cows. In Sept. or Oct. 1881 one aborted, and during the winter seven more did so. In the following winter six were similarly affected, and one in May 1884; none since. Mr. D. B. states that he bred from all his cows, and, strange to say, those that aborted the first year did not do so the second, though most of the remainder did so. He adopted isolation at first; it proved ineffectual, and was not persevered in.

He distinctly remembers in the first year two cows standing in the same stall served about the same time (he thinks by the same bull), one aborting, the other going full time; a precisely similar circumstance occurred in the second year. The cows were served by three bulls belonging to neighbours; no special blame could be attributed to any of them, as all had cases in this dairy. The owner of one had seven cows that aborted the first year, the other two had none.

Ergot found in pastures.

Total number, 15.

Farm 5.—Mr. G. P.'s. Mr. P. keeps about 10 cows. About seven or eight years ago he had 17 cows abort in two successive seasons. In 1882, one aborted in Feb., a second in April, and two more during the summer. Most of these occurred so long since, that minute particulars cannot be obtained.

Mr. P.'s cows were kept in three sheds, in all of which abortions took place, and the cows went their full time. Isolation was not practised, except in the first few cases.

Total number, 21.

Farm 6.—Mr. R.'s. I must apologise for inserting this case, as, though the malady is somewhat allied to that under consideration, it is not exactly of the same character. Mr. R.'s trouble is the difficulty he has in getting his cows to hold the bull, they, as a rule, requiring his services three and frequently more times, generally at the usual three-weekly interval, but sometimes at nine days. No abortions take place after the cows have gone two months, but up to that time the symptoms are sometimes seen. Mr. R. keeps two bulls, an Ayrshire and a Shorthorn, and has sent his cows to neighbour's bulls without benefit.

In the fifteen years he has been on the farm he has annually put one or two mares to the horse, with the result of three foals only.

No pigs or sheep are kept.

Ergot was *not* found on this farm.

Drainage and water are good.

If any of my readers can enlighten me as to the cause of this particular affection I shall esteem it a favour.

Farm 7.—Mr. J. G.'s. Mr. G. keeps about 28 milch-cows. He has two farms, one at which he resides, where the cows that are in-milk are kept; the other farm is two miles distant, where he keeps his heifers and cows not in-milk, and of late the animals from the home farm that have aborted.

His home pasture is formed of four or five fields practically thrown into one, by taking off the gates and attending to the boundary fences only. One side is bounded by a plantation, under the shadow of which I found large quantities of ergot, especially on cocksfoot, and some on rye-grass under the hedges, the exposed parts being practically free.

His meadows are at some distance from the pasture, being separated by a road, house, farm-buildings, gardens, &c.

A cow aborted in June or July 1884, a second in July 1885, a third late in August. These were isolated by sending them to the distant farm on the day of each occurrence.

Soon after the third case happened he turned his cows into the fog, or aftermath, where they remained for about six weeks, no abortions taking place whilst there. On Oct. 15th they returned to the pasture, and on the 19th the fourth case occurred, the cow appearing to be well until that day. The fifth took place on the evening of Dec. 8th, and was not removed till next day. At this time the cows were only out for an hour or two in the day. In Dec. a cow supposed to be due to calve in April, required the services of the bull; another, supposed to be due in June, was similarly affected late in Jan. These had probably slipped their calves unobserved whilst out. On Dec. 26th, Mr. G. informed me that two more cows appeared as if they would abort. I then strongly urged him to do what I had previously recommended, namely, to withhold the hour or two's grazing by keeping them indoors entirely. This he did, and the two cows which were then threatening were found to have cast their calves on the morning of the 29th, one in a small shed in which there were no in-calvers, and the other in a large shed with several.

Up to this time isolation had been strictly carried out. Now, doubting its utility, he not only allowed the last-named animal to remain, but on Jan. 2nd removed the one that had aborted in the shed in which there were no in-calvers to the larger shed. Thus, by placing the two aborting animals in close proximity to the in-calvers, and confining them entirely to the shed, he gave the infectious germs of this malady (if such there be) a favourable opportunity of asserting their presence, with the result *that no further abortion took place whilst the animals remained indoors from December to the middle of April.* Four cows in the meantime brought forth healthy full-time calves. In April the cows were again allowed to go into the pasture. In May an Alderney aborted at about three months off. In June a cow which had made her bag, and was supposed to be at her time (the time of service not having been booked), was sold, and taken away. Within a week she brought forth a calf without hair.

July 12th.—A cow aborted at about two months off.

August 7th.—A cow aborted after two days' premonitory symptoms. Here we have 11, if not 13, abortions occurring; the eleventh, without doubt, taking place at such times *only* as the cows had access to the ergotised pasture. Of the other two nothing more is known than previously stated; but as the cows were not absent from the pasture for more than a day or two at a time from Oct. 15th to Dec. 26th, if they did abort, they must likewise have done so whilst having access to the pasture.*

At the distant farm, which, as before mentioned, was used for isolating purposes and for non-milkers, no abortions had occurred until early in May 1886, when a heifer aborted. A second did so late in the same month, and a third in June; they were only having grass. None of the aborting cows had been sent there since Dec. 9th, 1885. Surely if that cow had conveyed infection, it would have asserted its influence in a less time than five months. No other source of infection is known. I have not yet inspected that farm, but ergot was present last autumn in one adjoining.

Total number, 14 or 16.†

Farm 8.—Mr. S. S.'s.—Mr. S. keeps seven cows. Early in August 1885, a cow aborted, a second did so early in September, a third in October, and a fourth in May 1886, six weeks off full time (calf living). This last-mentioned

* The cows were removed to fogg fields, August 20th, 1886, and up to this date, October 6th, they have gone on all right.

† Examined this farm on September 14th, and found ergot.

cow had been knocked down by another whilst going to drink, and had rolled down a steep bank a short time before casting her calf. The other three occurred whilst the cows were out. Ergot was present in the pastures. Isolation not practised, the remaining cows going their full time.

Total number, 4.

Farm 9.—Mr. T. D.'s. Usual number of cows kept, 8. This is the first instance in my investigations in which the first of a herd affected was known to be exposed to a *possible* source of infection. In October 1877 or 1878, within a few days of their breaking a fence and getting to a neighbour's cows, one of Mr. T. D.'s aborted; they were taken up in the latter part of the month, and from that time until spring all his remaining cows aborted from half time up to within six weeks of full time. In the following summer, all his heifers did likewise. He attempted to breed from all during the following winter, and, without an exception, they again aborted, mostly at an earlier period, from three to four months. He then fed them, and has continued that practice in all subsequent cases. He mentioned a symptom which came on whilst fattening that has not been noticed by my other informants, viz., the joints, especially knees, became enlarged, rendering them lame, and sometimes necessitating their being carted to the butchers. Isolation was practised in the early part of the outbreak. For the past six years he has had odd cases at intervals, generally two or three in each year, which have not been isolated. The last case was in March or April, 1885, when four in-calvers were in one shed; one aborted, her three companions going their full time in close proximity to the one affected. These cows were served by a neighbour's bulls. He keeps two, which serve all the cows in the township, and has himself only had an occasional case of abortion; and his other patrons, as far as is known, have been free from this affection.

I found an abundance of ergot in Mr. T. D.'s pastures, especially Moore-field, which was sown down eight or nine years ago, and has been mown twice since.

Two prematurely-born calves, from the same cow (not twins), grew up; they were small and delicate, unfit to breed from.

Total number 25 to 30.

Farm 10.—Col. S.'s. In the winter 1883–84 he had at this farm 10 in-calvers. In March one aborted at about half time. In April a second did so; the remainder, however, went full time.

In the winter 1884–85 he had four in-calvers. In March one aborted, and another in April, their two companions going full time.

Isolation was not practised in either instance. Straw was mostly given as long as it lasted, afterwards hay. In one, if not both years, the hay also ran short; it was then supplied from a farm on which milch-cows were not kept.

Total number, 4.

Farm 11.—Mr. J. H.'s. This case might have been noticed with, or preceded No. 10, as both occurred on the same farm. Mr. J. H., after an occupancy of nineteen years, left it in 1882. During his tenancy he had about six cows abort at intervals; they were not separated from the rest, but nothing approaching an epidemic ever occurred; he is quite sure that no two cases happened in close succession.

This is the farm into which Mr. T. D.'s (Farm 9) cows strayed, and from whence he attributed the source of infection to his cows!

Mr. H. does not remember the circumstance, consequently he is unable to say whether one of his cows had recently aborted or not about that time.

The bulls used were the same as No. 9.

Total number, 6.

Farm 12.—Mr. J. S. keeps 14 cows, 4 in one shed, the same number in a second, and 6 in a third.

Seven or eight years ago he had 7 cows abort in the winter, and the same number the following winter; none are remembered to have done so during the summer.

Isolation was not practised. Cases occurred, and cows went their full time in all the sheds. Nearly all were put to the bull again, most of them breeding; as far as can be recollected, no cow aborted a second time.

The cows do not graze on any land that has been laid down within twenty years; two fields were sown down eight or nine years ago, one of which has been made into hay every year, the other only for the past two seasons.

His own bull was used, which also served his neighbour's cows, none of which suffered, except on Farm 4, where three bulls were used that season, and each had cases of abortion.

Total number, 14.

Farm 13.—Mr. R. C.'s. Usual number of milking-cows kept, 10; but he deals in milch kine. They are kept in three buildings.

In Jan. or Feb., 1884, two cows from the same building aborted within a week of each other; each was isolated immediately, and the rest went full time.

About the same time in 1885 two more aborted within a week of each other. Mr. R. C. thinks they were in different sheds.

In June, when the cows were out, two aborted on successive days, and others have done so in each month up to September, the last one being one of those that had been similarly affected in the winter, and the only one put to the bull after such an occurrence. I heard that Mr. R. C.'s cows were affected, and went to take his case on Nov. 25th, but he was not at home. I then asked a lad to show me the pastures in which the cows had been during the summer. I found he had two, one in a westerly, the other in a southerly direction, each being formed of four or five fields, practically allowed to run into one. In the westerly pasture I found a little ergot in one field only; in the southerly pasture three of the fields contained a large amount of ergot in each. When taking his case on Dec. 2nd, I mentioned this to him: he immediately said, "I keep my cows in two lots, one consisting of milkers, the other of those that are dry and in-calf heifers. I have had none of the latter abort; they have been in the westerly pasture. The milkers have been in the southerly pasture; several of them have aborted, and some have gone their full time."

For a certain distance these pastures were separated by a fence only. Isolation is always practised immediately after the occurrence.

The bull used belonged to a neighbour; he served his owner's and other neighbour's cows, none of which aborted.

Total number, 10 or 12.*

Farm 14.—Mr. K.'s. Mr. K. keeps about 10 cows; he came to this farm in April, 1882. In the same month a cow belonging to the previous tenant aborted; a second and third did so in Feb. 1885, a fourth in March 1885, and a fifth in Jan. 1886. These cows have been frequently moved, so that a plan of their sheds would not be intelligible. No isolation was used; the cows went their time and aborted in close proximity. The previous owner and occupier (now dead) had abortions rather frequently amongst his cows; but an accurate number is not ascertainable.

Ergot sparsely found.

Total number, 5.

---

* Examined these pastures on September 6th, 1886. In those parts where ergot was so abundant last year there was scarcely a specimen to be found, grass not being very plentiful.

Farm 15.—Mr. I.'s. Mr. I. keeps 7 milch-cows. This case was taken on Jan. 8th, 1886, when ergot, if present, is not usually discernible. On April 12th, 1884, he brought from Mr. U., on whose farm abortion was said to be rife, three barren heifers, a cow newly calved, and a barren cow, that he thought afterwards (from external appearances) had cast her calf. To this last-mentioned animal Mr. I. attributed the blame of conveying infection to his herd, as in June one of his cows aborted, and between that date and April 1885 five or six more did so. All but two were out; these two were not together, but in sheds with other in-calvers, which went their full time, though isolation was not practised. In both years, Mr. I. had some ewes which aborted, consequently the abortion in the ewes must have preceded that of the cows. Further allusion will be made to this case, with reference to the suspected source of infection on Farm 26.

Total number, 6 or 7.*

Farm 16.—Mr. P. N.'s. Mr. P. N. keeps 4 or 5 milch-cows. In April, 1885, he purchased from the Mr. U. (mentioned in the previous case) three laying off-calvers; these were turned out with a home-bred in-calver, and during the first week in May one of the purchased animals aborted. The other three were immediately sent to a distant pasture, and in June his home-bred animal aborted, the other two going their full time. Mr. P. N. had two more in-calvers in a pasture near home, but not that in which the first had aborted in May. In July one of them aborted, but was not removed from her companion, who went her full time and calved in October or November.

On Jan. 25th, 1886, his only in-calver cast a living calf, about six weeks off the full term, the cow standing next to her having calved at full time two months previously. She had been fed with cake and hay from two stacks, and had an opportunity (when turned out to water) of partaking of a third sample of hay which had been purchased.

I closely examined the first two samples of hay, but found no ergot, though there were many dark suspicious-looking spikes of rye from which ergot might have fallen.

Further allusion will also be made to this case with reference to the suspected source of infection on Farm 26.

Total number, 4.†

Farm 17.—Mr. J. F.'s. Mr. F. keeps 8 cows in-milk and some heifers.

On Jan. 26th I was walking through his farm, and found a few ergotized grasses in a sheltered spot. I then made enquiries, and found that one of Mr. F.'s heifers had recently aborted. I called on him on the 28th. He informed me that he came to that farm in January 1880. In the following March a cow aborted, and two or three have done so each year since, generally about six weeks off their full time.

On January 10th, 1886, he observed two heifers due in March to be "springing." On January 17th one aborted. The other had made a fair "bag" by Jan. 28th, and might abort at any time. We then looked over the pasture on which the cows were allowed to graze for an hour or so daily, and found a few specimens of ergot in sheltered spots; we also closely examined the hay, but found nothing abnormal. I recommended him to keep the in-calvers up altogether, which he did, and no abortions have since taken place. The heifer which had made a fair bag *remained in much the same state, and calved at*

* On August 30th, 1886, I examined the pastures in which the abortions had taken place and found ergot in them; part of one had been mown, and the hay was then being carted to the stack; in this hay I found ergot still adhering to the spikes of rye-grass.

† August 30th, I examined these pastures and found ergot in them.

full time in the shed with the one that had aborted. Subjoined is a plan of the shed in which both heifers were; the plans of the other sheds it is unnecessary to give, as all went well in them. This is the only instance I have known when an animal has made such deliberate preparations (so to say) for premature calving, and then to adjourn the event until the proper time.

PLAN of MR. J. F.'s DOUBLE SHED (Animals back to back), taken January 28, 1886.

4.	3.	2.	1.
Due June 14. Calved at full time.	Due April 3. Calved at full time, April 1. Last year the one in this stand aborted about six weeks off.	Due March 1. Calved March 3.	In-calf, due May 8. Removed to No. 1 Shed, No. 1 Stand, on Feb. 24. Calved at full time.
5.	**6.**	**7.**	**8.**
Due March 8, aborted Jan. 17. Not removed.	Not certain whether in calf or not.	Due March 7, calved March 2. This heifer showed symptoms of aborting at about the same time as No. 5; by Jan. 28 she had made a fair bag. After that date none of these animals were allowed out. This one remained in much the same condition till she calved. Last year the animal in this stand aborted about six weeks off.	Calved in Oct. Now Geld.

This certainly appears as if she was, whilst in the pasture, getting *something* capable of producing the premonitory symptoms; but that, on being kept from the pasture, whereby the *something* was unobtainable, and not having previously taken quite a sufficient quantity of the "something" to actually bring on labour, her premonitory symptoms remained in abeyance, and she carried her calf the full period.

Knowing there was a "*something*" in that pasture capable of producing the symptoms, and that *something* was ergot, I think we may fairly assume that the symptoms were caused by that fungus; and, moreover, that if the heifer had been allowed to continue in the pasture, she would in all probability have picked up a further supply, which would have been sufficient to bring on premature delivery.

Total number, 14.

Farm 18.—Mr. J. D.'s. The subjoined plans of the shed explains all that is necessary, no abortions having taken place before or since on this farm. With the exception of grazing for an hour or two daily, they were all getting hay only.

The cows were served by the same bull.

Total number, 2.

PLAN OF MR. J. D.'s SHED.

4.	3.	2.	1.
Heifer due latter part of May 1885. Aborted late in Feb. Not removed.	Heifer due latter part of May 1883. Calved at full time.	Cow due in May 1883. Calved at full time.	Cow due about April 1883. Aborted in Dec. 1882, just before Christmas. Not removed.
4.	3.	2.	1.

Farm 19.—Mr. T. M.'s. Mr. T. M. keeps 5 cows. This case has much the appearance of an infectious malady, taken by itself. More particulars than contained in the following Plan could not be obtained, except that the cows were served by two bulls, and that they ran out for an hour or two each day. No abortions had occurred on the farm prior to Dec. 1883, and none since Feb. 1884.

Total number, 4.

PLAN of MR. T. M.'s SHED.

6.	5.	4.	3.	2.	1.
Aborted in Dec. 1885. Has since carried two calves their full period here. First to abort.	Geld.	Due in June, sold in May. She carried her calf the full period.	Aborted in Feb. Sold after being served.	Aborted in Feb. Sold after being served.	Aborted in Jan. 1884. Served again and went full time here, and has since carried a second calf the full period. Second to abort.
			Uncertain which of these two were the first to abort, they were both in same months.		
6.	5.	4.	3.	2.	1.

Farm 20.—Mr. M.'s. Mr. M. keeps 6 cows. This is the only instance in which I have found an undoubted example of the sclerotium of ergot in hay, though my friend, Mr. T. Toope, has since found some in large quantities in a stack some ten miles from here, as yet unconsumed.

Mr. M. mowed a field on August 11th and 12th, 1882 (the date is remembered because he left off mowing to go to the annual dinner given by M. F. H.). The weather being unfavourable, it was some six weeks before the hay was stacked, and it has only been used when better hay ran short.

In the spring of 1883 two cows aborted, and on Feb. 4th, 1886, another did so, all going well in the meantime. On both occasions this hay was given to the cows.

Total number, 3.*

PLAN of MR. M.'s SHED, taken February 16, 1886.

7.	6.	5.	4.	3.	2.	1.
Bull.	Calved Feb. 14, at full time.	Calved at full, Jan. 21.	Aborted at about 6 weeks off, on Feb. 4. Not removed. Calf dead but fresh. Cleansed two days afterwards. Ergot found in the hay.	In-calf, due in March or April. Calved at full time, May 4.	Fat.	Calved at full time. Feb. 14, 1886.
7.	6.	5.	4.	3.	2.	1.

Farm 21.—Mr. I. D.'s. At this farm a number of heifers are bought for fattening. Those that turn out to be in-calf are kept and calved, and then usually sold. In the spring of 1884 he had two abort in one shed, and one in another, none having occurred for many years previously or since. They ran

* September 1st, 1886, I examined the meadow on Farm 20, from which the hay was made which contained ergot as mentioned above. It had not then been mown; I found ergot in the grass. It had been pastured from 1882 till this year. On the same day I discovered ergot in some meadow *hay*, part of it having been already conveyed to the stack; it was on Farm 5. I think this was the second year the field had been mown.

out in the day, and had hay and cotton-cake at night. They were served by unknown bulls.

Total number, 3.

PLAN of MR. I. D.'s No. 1 SHED.

4.	3.	2.	1.
Heifer calved at full time in June.	Heifer calved at full time in May.	Heifer aborted about three or four days after No. 1. Calf born alive, about 5 weeks off. Not removed.	Heifer aborted about the middle of March 1884. Calf born alive about 5 weeks off. Not removed.
4.	3.	2.	1.

PLAN of MR. I. D.'s No. 2 SHED.

6.	5.	4.	3.	2.	1.
Stripper.	Heifer calved at full time in May 1884.	Heifer calved at full time in May 1884.	Cow in second calf, aborted a month off in April 1884. Had premonitory symptoms for a week. Not removed.	Stripper.	Heifer calved at full time in May 1884.
6.	5.	4.	3.	2.	1.

Farm 22.—Mr. T. T. keeps about 6 cows in-milk. In 1880 or 1881 a cow aborted in the summer, a second in autumn, and others during the winter and spring. Has had none since. The cow which had aborted first had been purchased two or three months previously.

Total number, 6.

Farm 23.—Mr. J. P. milks 6 cows, and generally has 3 or 4 calving heifers. Has had a case of abortion now and then for many years. In March 1883 a cow aborted, and was removed, the remainder going their full time. In January 1884 another cow in the same stand aborted about two months off. In February a heifer in another shed aborted about ten weeks off. She was again put to the bull, and aborted in the same stand in November, fifteen weeks off. In March 1884 a cow aborted about six weeks off. She was standing next to the one that had done so in January 1884. In May another, about a month off, aborted in the same shed, but with two in-calvers intervening between her and the last-mentioned cow, which went their full time, and the one next to her on the other side went her full time.

All went well until March 1886. In the meantime the old sheds had been pulled down, and a splendid new building erected some distance from the former site.

On March 15th a cow calved two weeks before her time, calf living. On March 12th a cow, not belonging to this farm, but here since November, which had aborted last year at her owner's, and which was again due in May, began to spring her udder, which went on until March 25th, when, for fear of infecting the others, she was removed a mile distant. On the 28th she aborted twins, which were putrid. Early in April a cow, due May 1st, which had shown premonitory symptoms for about a week, cast her calf, which was not putrid, but appeared to have been dead a week.

Total number, 8.*

* September 8th, 1886, I found ergot in the pastures.

Plan of Mr. P.'s No. 1 Old Shed.

6.	5.	4.	3.	2.	1.
Full time in 1883.	Full time in 1883.	Full time in 1883.	Full time in 1883.	Full time in 1883.	Aborted in March 1883, removed afterwards.
Calved at full time in June 14, 1884.	Aborted at a month off in May 1884. Not removed.	Calved at full time early in March 1884.	Full time in autumn 1884.	Aborted in March 1884, about six weeks off. Not removed.	A different cow to the above. Aborted in January 1884. Was not removed.
6.	5.	4.	3.	2.	1.

Plan of Mr. P.'s No. 2 Old Shed.

4.	3.	2.	1.
Barren.	Barren.	Aborted in Feb. 1884 at about ten weeks off. Again did so in the following Nov. at about fifteen weeks off.	Calved at full time in June 1884.
4.	3.	2.	1.

Plan of Mr. P.'s New Shed for 1886, taken March 20.

12.	11.	10.	9.	8.	7.	6.	5.	4.	3.	2.	1.
Clapham's cow aborted at her home last year; came here in Nov. 1885; is due in May. About March 12 showed premonitory symptoms, which continued till March 25, when she was removed for fear of infecting the others. On March 28 she cast twins, which were putrid.	Empty. Previous occupant calved at full time in Jan.	Due April 15, calved April 17.	March 15, calved two weeks before her time; calf living.	Geld.	Aborted early in April at about a month off; calf dead. Had premonitory symptoms one week. Not removed.	Empty.	Calved at full time, May 6.	Calved at full time, June 15.	Calved at full time, June 20.	Geld.	Calved at full time, June 2.
12.	11.	10.	9.	8.	7.	6.	5.	4.	3.	2.	1.

Farms 24 *and* 25.—These farms have each had one abortion this spring. One was undoubtedly due to an injury, the other to causes unknown.

I have retained their numbers, as entered in my note-book, for possible future events.

Farm 26.—Mr. U.'s. This is the farm from which Cases 15 and 16 were at first suspected to be the source from which their cattle were infected. Mr. U. keeps about 12 milch-cows. He entered on this farm in April 1882, on which abortions had previously taken place. At the sale of the outgoing tenant, March 17th, he purchased four in-calvers. Standing with them at the time of the sale was a heifer which had aborted two days previously. His four went their full time. In June two heifers which had been purchased elsewhere aborted, as did two more in July. He then decided to try to free himself of this plague by selling all his remaining in-calvers. These, nine in number, he sold to Mr. P. N. One of them was again sold, and she aborted in about three weeks from the time of leaving this farm; the remaining eight went their full time.

When he (Mr. U.) thought all infection must have disappeared from his farm he bought others, with the result that during 1883 some eight or ten aborted, most of them whilst out, but some when up altogether. They were not separated from the rest of the herd. The last two on this farm to abort did so either in December 1883 and January 1884, or in January and February 1884 respectively, in different sheds, of which he has three, in all of which abortions have taken place and cows have gone their full time.

Mr. U. takes his cows up in October. They are allowed to graze a short time daily during November (if mild), but not afterwards. He then feeds them with straw, turnips, lick (ground corn and chaff) and cake till late in spring, when they get hay. They go out, to drink only, daily. This water is the only instance in this series of cases which is open to suspicion. The supply is from surface drainage into a pond; it is plentiful in winter, but scanty and odoriferous in summer.

Here are two cases, one of which occurred in January or February, the animals getting neither hay nor grass after November. As they were in different sheds, infection was not likely to be the cause; neither from our present knowledge can we attribute it to ergot from the grass; nor do I like to suggest that it might have been in the cake or meal, though some writers have lately called attention to the frequency with which wheat is ergotised. I have never found it in wheat, though I admit never having sought for it there, but shall do so.

The abortion might have been caused by injuries or other incidental affections, but we have no evidence of it.

Mr. U., formerly a firm believer in the infectiousness of this malady, but, from his own experience, now a waverer, inclines to the opinion that these cases might have been caused by the turnips which had become heated and had sprouted. Such might have been the cause, but I have no reasons founded, either on theory or experience, to support it. I am unable to clear up these cases satisfactorily to myself.

With respect to the infection supposed to have been conveyed from this farm to Farms 15 and 16. The last case of abortion on this farm took place in January or February 1884. On April 12th, 1884, Mr. U. sold the animals mentioned under Case 15 to Mr. I. The newly-calven cow had gone her time; the barrener, which Mr. I. suspected as the cause of conveying infection to his herd, had calved a living full-time calf some four months previously.

I think we must admit that the suspected source of infection was merely a supposition.

Respecting No. 16, Mr. P. N. bought from Mr. U., in April 1885, three laying-off calvers, one of which aborted in May. That she could be capable

of conveying infection from a farm on which no abortions had taken place for fourteen months, and on which all animals had, in the meantime, gone their full term, I think the most ardent believer in infection would scarcely admit.

Total number, 14.

Farm 27.—Mr. W. S.'s. I heard in June that abortions had been taking place on this farm during the past winter and spring. It is 9 or 10 miles distant from here. I went over soon after hearing of the circumstance, early in June 1886. As I am not a Yorkshireman, I was unable (from Mr. S.'s dialect) to be quite clear about some of his remarks, or to get as minute particulars as I desired; but I managed to ascertain that he had about 14 cows abort during the past twelve months. They commenced soon after some had been to a distant field in which, I believe, other cows had been, and that most of his spring calvers had aborted whilst up, some in each shed, others going their full time with them.

He had mown the surplus grass of a pasture late last summer, which, with all his other hay, had been consumed, so that I had no opportunity of examining it.

Total number, 14.*

Farm 28.—Mr. H.'s. Mr. H. came to this farm in May 1884. In the following winter he had two cows which showed signs of aborting about the same time; they were then in different sheds, one in a shed with in-calvers, the other with only young stock as companions. The former was removed to the shed of the latter before abortion took place. Both aborted.

Mr. H. distinctly remembers they were then partaking of hay grown on a boggy piece of land. The higher portion of this field was plough-land, but the lower, whence the hay came, was too wet to plough. It was made in August, for he was stacking it when Lord H.'s party came grouse shooting.

Another aborted in January this year; she was not out, except to drink, after December; was fed on straw, wheat and barley-meal and chop, no hay.

Early in March a cow was knocked down—in the course of a week she threatened abortion, which came off a fortnight later, the calf being putrid.

Mr. H. has two cows due in September; one commenced to fill her bag a week since, and looks like calving in about a week from this date, July 22nd, 1886.

Total number, 4 up to date.†

Farm 29.—Mr. J. P.'s. Mr. J. P. keeps about 7 cows in milk, and some heifers. He resides at a village rather over two miles from here, in which, so far as I am aware, no previous abortions have taken place.

The soil is much lighter than the generality of land in this neighbourhood.

The heifers which had been allowed out during the day in winter, were turned out entirely on the 14th of May, 1886. They had no hay during winter. The cows were turned out a few days later, and they had received hay. Late in May a heifer aborted in "feeding pasture," at about two months off; she was

* September 16th, visited this farm and found large quantities of ergot in the pasture, which had been mown and converted into hay in 1885, the date of mowing being the 20th of August. The first case took place late in September or early in October, when out, the animal having access to this pasture and other fields.

The next occurred at Christmas, when in; from that time only three or four of his in-calvers carried their calves the full time. The animals were allowed out an hour or so daily. On the journey, I sought for ergot on the roadsides, but found none till I came to the lane leading to this farm.

† September 1st. Found ergot in the pasture in which the above-mentioned two cows (due in September) were in July, and are still. The one which showed premonitory symptoms in July cast her calf the first week in August; it is alive, running with its mother and the other cows, the rest keeping well.

immediately removed to a distant part of the farm. June 10th, a cow aborted in the "cow pasture." The cows and heifers had not been together since May 14th. The "cow pasture" and "feeding pasture" are parallel fields, with two small meadow fields, not in the occupation of Mr. P., intervening between them. Both are of sandy soil, and are bounded on the south by a stream. Adjoining which is a boggy place in each field. The stream runs from the "cow pasture" to the "feeding pasture."

The third case was a heifer in the "feeding pasture," on July 8th, at about half time.

The fourth was a heifer, two months off, on July 18th, in the same field. Mr. P.'s cows and heifers were served by four bulls belonging to neighbours; he cannot remember by which each animal was served, but is sure that these four cases were not all by the same bull.

Ergot nowhere visible in this neighbourhood at present, July 23rd.

Total number, 5.*

Farm 30.—Mr. J. C.'s. Mr. C. keeps 3 or 4 cows. In August 1882 a heifer aborted about three months off, not separated from the others. In October 1883 a heifer aborted, seventeen weeks gone. This is the cow referred to in Case 24 as "Clapham's" cow, which subsequently aborted twins. About the same date a heifer, supposed to be eighteen weeks gone, came bulling; she had probably aborted unobserved whilst out.

In December a cow aborted seven weeks off.

In March 1885 another cow did so at about the same period of gestation.

Total number, 4 or 5.

Conclusion.

I have now given extracts from my notes of every outbreak of this malady which has occurred in this district during the past eight years, so far as I know. I have purposely omitted notes of a few isolated cases which took place previous to the commencement of these investigations.

It is quite possible that in some instances, even where it has assumed the form of an epidemic, its presence has been so secretly kept as to have escaped my frequent enquiries.

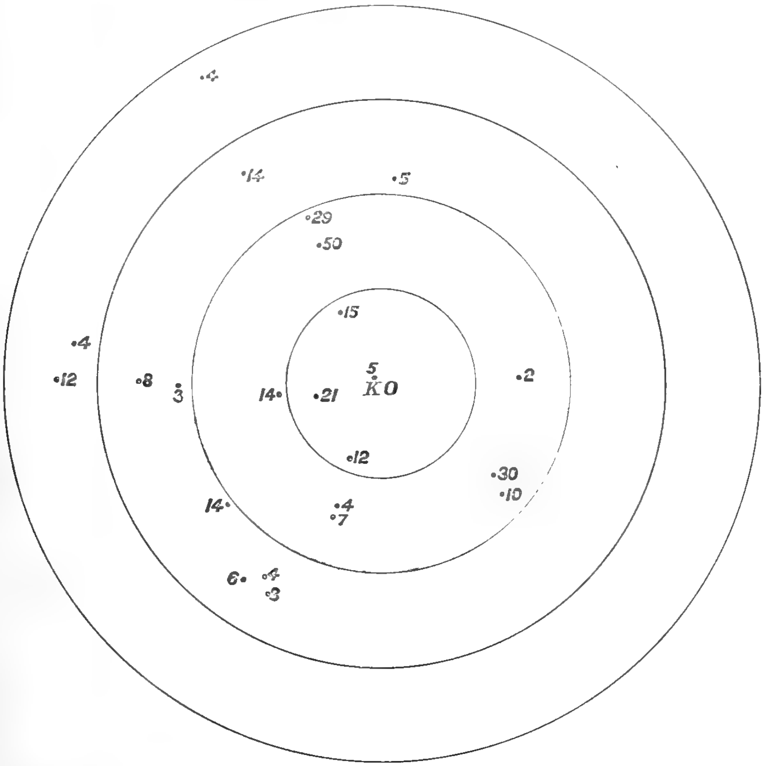
So universal is the belief in its infective properties, that where I know the malady exists, or has been recently present, I have

* On August 11th, a heifer in "feeding pasture" calved apparently at full time. August 17th, a cow in "cow pasture" aborted at about half time, no premonitory symptoms being observed, as she was milked and appeared as usual in the morning. On the 21st, by my recommendation, all the in-calvers were removed to fogg fields: up to this date, October 6th, no further abortions have taken place, though one or two cows are very near their full time. Mr. P. now thinks his cows must have been casting their calves previously to May, as he has only one yearling on his farm of his own breeding. The calves either being born dead, or dying in a few days after birth. Being himself rather delicate and frequently unable to superintend such matters personally, he had attributed such frequent occurrences to neglect or mismanagement, never thinking of premature delivery. In September I discovered ergot in the "feeding" and "cow" pastures, though only in small quantities, as from the dry summer they had been eaten so bare as to present but few grasses on which it could be apparent. If ergot was the cause of these abortions, it must have been of last year's growth, and picked up by the animals when baring the pastures so closely.

October 4th. More grasses in seed present; nearly or quite one-half of such being infested with ergot.

frequently had to use all my persuasive powers to assure such owners that "I am not a sort of detective sent by Government to prevent them spreading the disease by sending their produce to market," before I can get any information on the subject. On the other hand, I am greatly indebted to many for the valuable information and assistance given on this subject, especially the proprietors of Farms Nos. 1, 3, 7, and 17. In round numbers these

Fig. 1.—*Diagram showing the distribution of cases of Abortion in the neighbourhood of Kirkby Overblow.*



investigations record 300 cases of abortions in cows; of which no fewer than 200 have occurred within two miles of my house, the average loss from which has been variously estimated at 10*l.*, 8*l.*, and 7*l.* per case. The difference in the estimates arises from the varying price in the animals themselves and their produce. Here we have a total loss to the farmers, within two miles of Kirkby Overblow, taking the average at 8*l.* per head, of over 1600*l.* Such a fact I deem sufficient to excuse the

length of this article, and the many recapitulations, without which, I fear, I should be unable to sufficiently impress on my readers what I consider the more prominent features of this enquiry.

The causes usually assigned for producing this malady are: impure water, diseased bulls, injuries, mal-position of uterus, badly-constructed stalls, feeding on hilly pasture, fright, excitement, exhaustion from any cause, purgatives, febrile or other debilitating diseases, infection, sympathy, and ergot.

Impure Water, as before mentioned, cannot be regarded as a cause in this district.

Diseased Bulls.—I think a careful perusal of these cases must exonerate the male, as very few had their affections confined to the animals on the farms affected with this malady. A writer states that gonorrhœa in the bull caused a dairy to abort; such might have been the case, but, judging from its effect on the human subject, I should not have expected it. Syphilis in the human subject is an undoubted cause of abortion; and it is, so far as we know, the only predisposing cause in the male parent. The bovine tribe are, I believe, insusceptible of true syphilis, though my friend, Mr. Toope, informs me that bulls are liable to a disease somewhat resembling it, but the symptoms are of such a nature as to prevent it being overlooked.

Injuries.—Mal-position of uterus, badly-constructed stalls, feeding on hilly pastures, fright, excitement, exhaustion, purgatives, may each cause an individual cow to abort, but that any effluvium arising from a case so produced is capable of causing an otherwise healthy cow exposed to such emanations to abort, I do not believe. Febrile or any debilitating diseases will certainly predispose an animal to abort; and if the nature of the disease be such as seriously to interfere with the normal physiological functions, we should expect such an occurrence. But that there is an infectious disease, the outward and visible sign of which is abortion *only*, I have no reason whatever to believe.

Infection.—If this malady possessed the infectious properties usually assigned to it, we should naturally expect that the following suppositions would be correct:—

1. The source from which the first of a herd was infected could frequently be traced.

2. A cow having aborted, the in-calf animals in closest proximity would be more likely to suffer than those more distant, and more especially so, than those in a separate shed.

3. That by intentionally keeping the affected animals in closer proximity to healthy in-calvers, by confining them to their sheds entirely—the disease would spread with greater rapidity.

4. Isolation, promptly effected, would stamp it out.

5. That affected animals, whilst grazing, would sometimes impart the malady to in-calvers in adjacent fields.

6. That a change of hay or grass (all other circumstances remaining unchanged) would be ineffectual to arrest the malady.

7. That animals known to have recently aborted would be capable of conveying the infection to others.

Animals so much under supervision as milch-cows, whose daily walks are usually restricted to certain fields, have so few opportunities of coming in close contact with similar animals of another herd unobserved, render them good subjects for tracing the source from which an infectious disease is primarily imparted to them. Yet in three cases only, Farms 9, 15, and 16, have the owners been able to attribute a *possible* source of first infection, though all firmly believed their subsequent losses to be due to infection only. Let us carefully enquire into the circumstances on which they founded their opinions.

In October 1877 or 1878 the cows of Mr. T. D. (Case 9) strayed on to the adjoining farm (No. 11), and remained there an uncertain time in company with the cows belonging thereto; it might have been an hour or two, or perhaps for a few minutes only. In a few days one of the straying cows aborted, and was immediately isolated; the others were taken up later in October. During the two following seasons every cow and heifer on the farm aborted. This assuredly has the appearance of an infectious malady; but since that time, six or seven years ago, Mr. T. D. has had two or three abort annually which have not been separated from the others. The last occurred in March 1885. She was in a building with three companion in-calvers, each of which went their full time, though she remained in close proximity with them. Surely, if there was sufficient infection hanging about this building to cause this cow to abort, we should naturally expect it to be so increased by her emanations as to cause some or all of her companions to be similarly affected.

Now for the reputed source of infection. Mr. J. H. (Farm 11) was on the farm nineteen years, during which time he had about six cows abort at intervals. He is quite sure he never had two or three in quick succession; they were not isolated. He does not remember the circumstance of Mr. T. D.'s cows getting to his; consequently he is unable to say whether any of his cattle had or had not recently aborted. Assuming there was a recently-aborted cow in the herd of No. 11, and that such a cow was capable of producing specific abortive germs, would not her companions who were in constant association with her be more likely to be affected by such germs, than the strangers who were only a short time in the field? Yet they remained healthy. Then again, the two or three per year at intervals, on Mr. T. D.'s

farm, have not caused the remaining cows to be affected, although they have not been separated from them. So that in this instance the circumstance of No. 9's visit to No. 11 may fairly be regarded as a coincidence rather than a cause of the subsequent outbreak.

Farms 15 and 16 may be taken together, as both had purchased animals from Mr. U. (Farm 26), on whose farms abortions were supposed to be rife.

On April 4th, 1884, Mr. I. (Farm 15) bought from Mr. U. three barren heifers, a newly calved cow, and a barren cow. We must confine our attention to the latter animal, as it was to her Mr. I. attributed the blame of conveying infection to his herd. In June (six weeks at least, and may be ten), after the importation of this cow, one of his cows that was in the field with her aborted; between that time and April 1885 five or six more did so. With the exception of two, all aborted whilst out. These two were in different sheds, and each having in-calvers in close contact with them, which went their full time.

In April 1885, Mr. P. N. (Farm 16) purchased from Mr. U. three laying-off calvers; they were turned out with a home-bred in-calver, and in May one of the purchased animals aborted. The remaining three were immediately sent to a distant field, and in June his own-bred animal aborted, the other two purchased animals going their full time.

On taking Mr. U.'s case (Farm 26) he informed me that the barren cow he sold to Mr. I. had *calved a living full-time calf*, some four months previous to his leaving the farm. If the infection came from this farm (26) to Farm 15, it must have been conveyed by an unaffected animal, from one which had aborted in January or February.

That it could be so conveyed as to cause an animal on a farm five miles distant to abort in June, I think highly improbable; or that a heifer which left the farm fourteen months at least after the date of the last abortion (on which all cows had in the meantime gone their full time) could have received infection previous to leaving so as to cause her to abort a month later on Farm 16 also five miles distant, I think this too is highly improbable. When we remember that ewes had aborted on Farm 15 previous to the arrival of the suspected animal, and the irregular manner in which the animals were subsequently affected by this malady, it has more the appearance of being caused by some substance on the Farms 15 and 16 than by infection from Mr. U.'s farm. Thus the only three instances in which a *possible* source of infection could be suggested have, on investigation, proved to be *extremely unlikely and improbable.*

2. "A cow having aborted, the in-calf animals in closest

proximity would be more likely to suffer than those more distant, and more especially so than those in a separate shed."

In this part of the country it is very uncommon for a farmer to keep all his milch-cows in one shed, but generally in two or three and sometimes more. In no instance have I known this malady, where it has assumed the form of an epidemic, confine itself to one shed, when more than one was occupied by in-calvers; nor have I known three animals standing next each other to abort successively. In a few instances two have done so. Farm 3, No. 3 shed, No. 6 stand, is the only stand in which I have heard of a cow showing symptoms of abortion (for she did not actually abort there), in which another was placed which soon afterwards aborted. Even in this instance, in the adjoining stand (same stall) an in-calver remained for thirteen days after the first aborted, and eventually carried her calf the full time.

With the exception of Farm 1, in which all the in-calvers aborted up to the change of hay, Farm 7, where all aborted for two seasons, and Farm 19, in which the remaining in-calver was sold, cows have gone their full time in every shed in which abortions have taken place.

This malady has never been known to follow the cows milked by one man. It appears to take no definite course, but to strike at random first here then there, very unlike an infectious disease.

3. "That by intentionally keeping the affected animals in closer proximity to healthy in-calvers, by confining them to their sheds entirely, the disease would spread with greater rapidity."

In the only three cases in which I have advised this treatment, and it has been acted on, not only has the disease not spread with greater rapidity, but it has actually stopped, except in the cases of those in-calvers who were showing premonitory systems prior to their confinement to the shed, and ceased altogether when *they* had cast their calves. The three cases I refer to are Farms 1, 7, and 17. In this latter case the heifer which showed unmistakable premonitory symptoms of aborting did not carry it into effect, the curious treatment for an infectious disease being apparently just in time to prevent the catastrophe.

In Nos. 1 and 7, the treatment was not in time to prevent the threatened abortions taking place, but it stayed the further progress of the malady in both instances. In No. 7, the treatment was effective as long as it was persevered in *only*, cases recurring soon after their being turned out to pasture. Farm 3, No. 5 shed, No. 2 stand, may be instanced as affording a crucial test of the infective powers of this malady. It could not be said that the animal experimented on was insusceptible of the disease,

as she had the previous season suffered from it. Neither can one attack of this malady, as is the case frequently in infectious diseases, act as a prophylactic against its recurrence, we having so many instances of animals aborting a second time. So much more likely are cows considered to again abort after once being so affected, that it is the rule (with exceptions) in this district not to attempt to breed from them.

4. "Isolation promptly effected would stamp it out." Isolation was tried in pretty nearly every outbreak at its commencement; in some by sending the affected animals away either before or immediately after the occurrence; in others by keeping them in a separate shed in which gas-lime was sometimes thickly spread on the floor. In all with the result that, however it was carried out, its beneficial effects could not be perceived.

5. "That affected animals, whilst grazing, would sometimes impart the malady to in-calvers in adjacent fields." Certainly we should expect an infectious disease to spread under such circumstances, but not one of the thirty attributed their outbreak to such a source. I have knowledge of a few instances where animals were so placed without any deleterious result. Reference under this head may be made to Case 13.

6. "That a change of hay or grass (all other circumstances, so far as known, remaining unchanged) would be ineffectual to arrest the malady." Nos. 1, 2, and 3 negative this rule with respect to hay. Nos. 7 and 3 tend to do the same with regard to grass. In the former, I refer to the six weeks' change from pasture to aftermath; in the latter, to the intermission whilst the heifers were in the Ridge fields. No. 26 also bears on this point, as in 1882, finding the majority of his in-calvers aborting, he determined to try to clear his farm of infection by selling his remaining (nine) in-calvers. This he did to Mr. P. N., one of which aborted within three weeks of leaving, the remaining eight carried their calves the full period.

7. "That animals known to have recently aborted would be capable of conveying the infection to others." I have no evidence that this malady has ever been so conveyed, though the opportunities of doing so were frequent, as two farmers who were heavy losers by this affection were largely dealing in milch-cattle during the time that their own herds were suffering heavily. Cows were generally purchased a few days or weeks prior to calving, and were sold a few days after the event. They frequently calved in close proximity to aborting animals, sometimes in stands recently occupied by such. The animals which aborted, if they made fair bags, were sold in the usual course; but the best were not fit for sale under ten days, and some for

three weeks, whilst many made such poor bags that it was useless to offer them for sale.

Fair opportunities were thus given of disseminating an infectious disease, as cows which had remained for days in close company with diseased animals, in sheds which would be highly charged with infection (if any could be), were, with animals which had actually aborted, sold indiscriminately.

I know many of their customers, but I never heard of any animals sold by them being accused of conveying infection to others. Nor have they.

Having now considered the facts observed in connection with this malady, and compared them with what we might naturally do in an infectious disease, I cannot think any one, if he be at all conversant with diseases of an infectious nature, can conclude that the one under consideration is of that character.

Sympathy.—By many writers this is alleged to be a frequent cause of subsequent abortions after one has taken place in a herd from any cause. If this allegation be true (keeping infection quite distinct from sympathy), whatsoever it may be which causes the animal to abort, must be conveyed to its brain by means of the special nerves of sight, hearing, or smelling. I suppose all will admit that the visible and auditory accompaniments of a cow in the act of calving are quite as intense when this function is performed at full time as when it takes place prematurely. If such be admitted, we must exclude the first two special senses, sight and hearing, from being concerned in the production of this malady, or, on the occasion of a cow calving at full time in the presence of in-calvers, we should frequently have abortions quickly follow—which we do not have.

The sense of smell alone remains by which an animal can thus be affected. To influence this, we must have an effluvium proceeding from an aborting animal either of an entirely different character to that arising from one calving at full time, or the same, highly intensified. Whichever it may be, it must be of such a character as to produce a shock or impression on the nervous system of the animal sufficiently powerful to cause her to abort. Without going into the subject of such animals' greater power of smell than we possess, I will confine myself to what we can perceive. Occasionally a calf is prematurely expelled in a putrid condition; but in the subjects of these enquiries this is quite the exception. As a rule, the smell or effluvium perceptible to us from a cow aborting is indistinguishable from that accompanying delivery at full time.

Making due allowance for the alleged increased sensitiveness to smell in an in-calver, and admitting the possibility of a sufficiently powerful effluvium to be sometimes present in con-

nection with an animal aborting (or having recently done so) as to cause such in-calver to abort—we should naturally expect such circumstances would have arisen, and such results followed, in some of the 300 cases mentioned in this article, *of which we have not the slightest evidence.*

Most of those suppositions, which I have tabulated as what we ought to expect if abortion be due to infection (and which we do not find in this affection), are equally applicable if it be due to sympathy—especially those relating to isolation, and keeping the animals altogether indoors.

It appears to me that sympathy is assigned to be a cause of this malady as a sort of makeshift, when no other theory will fit in. It would indeed be sometimes an extremely useful therapeutic agent if it would act on the human subject.

From my recent experience amongst quadrupeds, and my more prolonged acquaintance with parturient bipeds, I must assert that if sympathy, pure and simple, be ever a cause of abortion, it must be an extremely rare one.

Articles of food now claim our attention.

Straw,* and all artificial or supplementary food, as cake, roots (though the latter was suspected in Case 26), may be excluded; as cases have occurred whilst the animals have been partaking of all, but nothing points to any one of them as largely contributing to this malady, neither being universally given to the cattle affected.

Grass and hay remain for consideration. We know of no grass in its normal state or herb capable of acting directly on the uterus so as to cause it prematurely to part with its contents. A strong purgative might indirectly do so by reflex action, but purgation did not accompany nor did it precede the malady in these cases.

Ergot.—But we do know of a fungus, that infests grasses as well as food-cereals, which has a special action on the uterus, and is capable of causing it prematurely to contract, and so to bring on the malady under consideration. A short description of the growth of this fungus may be useful.

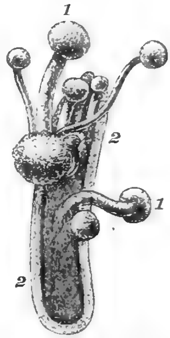
Ergot (*Claviceps purpurea*, Fig. 2) is a fungus which attacks grasses in the flowering stage. It eventually takes the place of the seed, and attains in the cereal rye to the length of nearly an inch. It is somewhat smaller in grasses, being to a certain extent, I believe, proportional to the size of the seed it replaces, although

* I have recently examined a field of seeds with which a crop of wheat is growing; I found a quantity of ergotised rye-grass. If cows be fed with either the grain or straw from such a field, we might have ergot introduced from an unsuspected source.

if it is allowed to attain its full growth it is always larger than the individual seed would have been whose place it usurps.

Most of our grasses are liable to be infested by it, but in this district I have found a much greater proportion of it on rye-grass than on any other; cocksfoot, timothy, the fescue grasses and Yorkshire fogg (*Holcus lanatus*) coming next in order. It attains its full growth in about three months, and soon afterwards it becomes detached from its host and falls to the ground, where, unless it is picked up, it remains until the warmth and moisture of early summer causes it to undergo changes which result in the development of myriads of very minute spores. These when fully formed are shot up into the air by the bursting of their covering, and if they alight on, or are carried by the wind or insects to the pistil or young seeds of flowering grasses, they take up their habitation thereon and develop into the visible ergot.

Fig. 2.—*Claviceps purpurea.*



1. *Ascophores.*—Fleshy, pale purple, head globose, stem curved, sporidia attenuated.

2. *Sclerotium.* — Horn-shaped or club-shaped, purple-black, white within when broken.

While the ergot is growing it is capable of affecting grasses that are later in flowering than those on which the ergot is situated in two ways. At an early period of its growth a glistening drop of a syrupy consistence is formed on the spike, which attracts flies. It contains mycelium, which may be carried by these insects to other flowering grasses, and thus causes new growth.

Conidia are also formed on the external surface of the growing ergot which may be carried by the same agency, or by the wind, with a like result.* An interesting article on ergot, which appeared in the 'Journal of the British Dairy Farmers' Association,' by Prof. Fream, may be advantageously read. For a minute life-history of this and other fungi, that splendid little book entitled 'Diseases of Field and Garden Crops,' by Worthington G. Smith, may be consulted; it should be in the library of every agriculturist. The 1874 'Journal' of this Society contains an excellent description of ergot and the mode of its growth, by Professor Carruthers, from which the appended illustrations are taken.

Ergotised grasses are not frequently found growing universally

* The first ergot I found this year was on August 19th; I placed it in a drop of water and rolled it over a few times, then with a camel-hair brush moistened each protruding stigma of two blades of rye-grass, which were growing on a rockery. Ergots are now visible on nearly every spikelet (October 6th).

Fig. 3.

Rye, *Secale cereale*, Linn. Spike bearing several Ergots.

Fig. 4.

Awnless Darnel, *Lolium arvense*. With. *L. temulentum*, L. var.

over a field, but in patches, which are generally in sheltered and shady places, as under trees, hedges, &c. This accounts for part of a herd remaining healthy whilst others are attacked.

I have seen it stated "that when abortions take place in the spring months they cannot be due to ergot, as it is not then present." This, I think, is incorrect, as it certainly may be present, though not easily visible. I have records of abortions taking place in every month of the year—the spring months being by no means less favourable to this disease than others.

Ergot may be, and probably is, eaten in three periods of its growth.

1. In its very young state, when its host is moderately tender and succulent.

2. When it has nearly or quite attained its full growth, but is still attached to the stem of its host, which has now become somewhat old and tough.

3. When it has fallen from the stem to the surrounding herbage.

In the first stage it may sometimes be eaten; but even then the grass must be past its flowering stage, and cows do not readily eat such stems if there is plenty of surrounding

herbage. The second period is that in which it is generally believed to be eaten, as it is then visible; but, from personal observation, I think it is then least often partaken of, as I have watched cows grazing, and noticed how they avoided the old stems of rye-grass, whether ergotised or not, whilst closely cropping the

Fig. 5.

Timothy Grass, *Phleum pratense*, Linn.

Fig. 6.

Barley Grass. *Hordeum murinum*, Linn.

Fig. 7.

Spikelet of Rye with Ergot. Natural size.

surrounding herbage. The bottom-grass must be scarce when these are readily eaten. The third stage is that in which I think it does the most damage, both on account of the active principle of ergot being more powerful in its adult stage, and

from the fact that the period comprises some nine or ten months out of the twelve. *The shorter the herbage, the more likely is ergot to be picked up by an animal.* The comparative immunity of "lane-cows" (*i.e.* those grazing on the roads) from this malady puzzled me for some time, as the herbage on road-sides consists chiefly of rye-grass, and is particularly infested with ergot, on account of being sheltered from the wind and sun. These cows have also greater opportunities of contracting this malady from infection (if that be possible) than ordinary farm-cattle, as in their peregrinations they are not only liable to be infected by local animals, but by strangers on their way to fairs, markets, &c. This comparative immunity must be due, I think, to the following circumstances:—

1. They are only on the roads from May to October, and then only for a portion of each day.

2. The large percentage of cows are spring-calvers, consequently, during the time that they are on the road-sides, such animals are without calf, or only recently bulled.

3. The grass is not often so closely eaten as is the case frequently in pastures. Thus ergot is not so likely to be picked up.

On ascertaining the above facts, I was no longer puzzled at their comparative immunity.

When writing on this subject in December last, I said, "I have examined the pastures on all the farms mentioned in this Report where abortions have recently taken place, and without exception have found sufficient ergot on each to account for such occurrences." That statement still holds good for the enquiries instituted up to that date, viz., from 1 to 13 of the series. To make it applicable for the whole series of 30, it must be modified by the addition of the sentence, "When such examinations were conducted at a time that ergot, if present, would be readily discernible." The last seventeen enquiries took place between January and July 1886, during months when ergot, as a rule, has fallen to the ground.* I did find a few specimens on

* On September 5th I found ergot in large quantities in a recently sown-down pasture; I then made enquiries of the bailiff in charge of the farm, who informed me that in the spring of 1883 or 1884 all the in-calf heifers aborted, as well as most of the cows, the whole number of abortions amounting to seven or eight, out of a total number of ten in-calvers; and as the calves had not previously done well, the proprietor had given up breeding.

September 7th.—Mr. L.'s only cow cast a living calf about a month before her time. I found nearly every rye-grass in the small pasture infested with ergot.

September 15th.—I visited Mr. T. U. at K., some seven miles from here. He came to the farm in 1882, and has had six or eight cows abort annually since that time. In the somewhat bare pastures I found about one-half of the grasses, capable of bearing visible ergot, infested with that fungus. In a cornfield on some waste land adjoining the river, I found ergot growing in such abundance as I had never previously seen; every grass and nearly every spikelet seemed to be infested with it. Mr. U. informed me that one neighbour had had from twenty to thirty cows abort recently, and another had about four during the past spring.

January 28th in a sheltered spot (Farm 17), but that was exceptional. I have not discovered any of this year's growth up to this date, August 16th. I think it probable there will be a scarcity of this fungus this season, as it requires heat and moisture to enable it to develop its spores; and here, at least, we had very little of the latter, whilst the main crop of grasses were in flower.

So great was the deficiency of moisture, that many grasses withered whilst in full flower, and failed to develop seeds. Again quoting from the article of December, which requires modifying as before, "Here we have a fungoid growth capable of producing this affection. This growth is invariably found (in my experience) in all pastures where cows have recently aborted whilst out at grass, and as no other agent known is capable of producing this malady, I think we are justified in assuming that ergot is the chief cause of abortion in cattle when abortions occur in such numbers as to exclude injuries, and other incidental causes of this disease."

In the December article I ventured to predict that, the hay being gathered some three weeks earlier than usual—in 1885—we should not have, in this district, such severe outbreaks of this affection during the winter months as we previously have had. On two farms only (3 and 27) have we had anything serious. On each, the surplus grass of a pasture was mown and made into hay *after* the ordinary haymaking was over. In the case of Farm 3, it was mixed with other hay, which I examined on two occasions, but was unable to find an undeniable ergot, though I found several dark-coloured, suspicious-looking spikes.

That of Farm 27, I had no opportunity of examining, as all the hay on the farm had been consumed at the time of my visit.

That hay in some instances contains something capable of causing abortion, may be inferred from the malady suddenly ceasing when the supply from certain stacks has been withdrawn.

Farms 1 and 2 are good examples.

During the past winter I have examined numerous stacks of hay made last year, with the object of discovering ergot, but without success. Some writers allege that it cannot be present in hay, as it would be knocked out by the many shakings which grass undergoes whilst being converted into hay. In February I came across the remains of a stack made late in 1882; on examination, I found a few undoubted examples of ergot, in the sclerotium stage, adhering to the spikelets of rye-grass. This hay was mown on the 10th and 11th of August, 1882. Wet weather set in, and the hay went through many shakings, as it

was fully six weeks before it was stacked. It can well be imagined that when it was stacked it would not be of the best quality; to this circumstance I am indebted for the opportunity of examining it, as it was only used when better hay ran short. Two cows aborted in 1883, and one on February 4th, 1886, all whilst partaking of this hay; it was from enquiries into what the latter animal had been eating that this hay came under my notice.

Mr. Toope, veterinary surgeon, Knaresborough, has since found large quantities of ergot in a stack of seeds made late (August 1883 or 1884). This has not been used. He had previously suggested to me the possibility of the fungus in mouldy hay being a contributor to this malady. I therefore made particular enquiry as to the condition of the hay used when the severe outbreaks were present, as well as to the time of its making. All the owners stated that the hay used on these occasions was made *late*, but none admitted it to be mouldy. I have not actually found ergot in hay where a number of animals consuming it have aborted, as I have had no opportunity of examining such; but as we now know that it is occasionally present in late-made hay, and as most of the serious outbreaks took place whilst the cows were partaking of late-made hay indoors, I think we may fairly assume that ergot in hay was a frequent cause of this malady.

It is therefore probable that ergot may cause abortion :—

1. By one or more large doses acting quickly, when no premonitory symptoms are observed.

2. By several smaller doses, the premonitory symptoms being well marked and observable for three or more days prior to abortion.

3. I have had a few cases where abortion has taken place some weeks after the cow's withdrawal from every apparent source of ergot. In such cases I think it possible that a sufficient quantity in small doses has been consumed to cause a tonic contraction of the uterus, whereby it is unable to expand in a due ratio to the growth of the fœtus; the latter, by its growth exerting a continuously increasing pressure from within on the rigid uterus, ultimately acts as a foreign body, and so stimulates or irritates the uterus as to cause its expulsion. These are conjectures of my own, and must be affirmed or negatived by further observations and experiments.

The Nature of the Soil has not, so far as I am aware, received attention from writers on this subject. I am not prepared to give a scientific description of the geological formation of this district; but this I know, that, where the disease has been most prevalent, the farms have almost universally consisted of stiff clay land,

underneath which is millstone grit. I have also noticed that the north side of Kirkby Overblow, where the land is of a lighter consistence, the malady is nearly unknown. Mr. Toope has made special enquiries as to its presence around Knaresborough, which is on the magnesian limestone, with the result that it is extremely uncommon, and anything approaching an epidemic has not taken place there in recent years.

To ascertain if the nature of the soil is really an important, though indirect, agent in the production of this affection, or whether the circumstances noted in connection with this series of outbreaks are merely coincidences, must be settled either affirmatively or negatively by more extended observations. That the land itself can directly produce the disease I do not believe, as some of the serious outbreaks took place whilst the cattle were indoors altogether, but it may possibly indirectly contribute to it:—

1. By favouring the growth of the very frequent host of the fungus—rye-grass.

2. From its physical character it might retain the spores of ergot on its surface longer than would be the case on a more porous soil.

3. It is just *possible* that grasses grown on clay land may possess some chemical constituent favourable to the growth of the fungus; such chemical constituent either being in excess of that in grasses grown on lighter soil, or an additional one.

These are merely surmises on my part.

Summary.

To summarise the foregoing:—

1. Three hundred cases of abortion have taken place within a small area.*

2. Two hundred of these have been within two miles of Kirkby Overblow on stiff clay-land.

3. On light lands in this neighbourhood serious outbreaks are unknown.

4. Imperfections in bulls, bad water, infection, sympathy, &c., have had little or no effect in contributing to this malady.

5. Cows abort in each month of the year, and at any period of gestation after the fourth month. In the later months calves are frequently born living; at other times generally fresh, rarely putrid.

6. An animal which has once aborted, may or may not do so again.

---

* Since the above was written, my investigations have extended to nearly 400 cases.

7. Premonitory symptoms may be practically absent, or may be present fully three weeks prior to the abortion.

8. Cows aborting do not give the quantity of milk which they would otherwise do by one-third to one-half.

9. They do not fatten for some two or three months after such an occurrence.

10. Isolation has had no appreciable effect in preventing the extension of this disease.

11. Ergot was found on every farm where abortions had recently taken place, when sought for at a time that it would be visible if present.

12. Ergot could not be found when specially sought for on Farm 6, where the malady under consideration was not present.

13. Four or five only out of the 300 cases had no opportunity of partaking of hay or grass within a month of aborting.

14. Removal from known ergotised fields to aftermath, and to sheds (entirely) has, on several occasions, cut short the disease.

15. In all the serious outbreaks which took place whilst the cattle were entirely indoors, some of the hay then consumed was made late.

16. The only instances in the winter of 1885 and 1886 where serious outbreaks occurred, both the farmers had mown late the surplus grass of a pasture.

17. Ergot has been found in late-made hay.*

From these facts I cannot absolutely prove ergot to be the cause of this malady, but the circumstantial evidence in favour of it is so strong, that, with my own personal knowledge of its specific action on the uterus, it leaves no doubt on my mind that this fungus has been the absolute cause of the vast majority of these 300 cases of abortion. The only way satisfactorily to place the matter beyond doubt, is by intentionally producing abortion in a certain number of animals, they being in company with others, and all being placed under precisely similar circumstances, with the exception of the administration of ergot to a certain number.

Mr. Toope informs me that he has in several instances brought about abortion in bitches by subcutaneous injections of a preparation of this substance; but for the absolute proof and demonstration to those unacquainted with its powers, and also for more precise information on the subject, the undermentioned, or some similar experiment, is urgently needed, as, so far as I know, the actual production of this malady has never been intentionally brought about by administering this sub-

* Three times by myself, and once by Mr. Toope.

stance "*per vias naturales*" to animals of the bovine tribe. The following is the outline of such an experiment:—"Purchase six in-calf cows in August, if possible served by the same bull, and due to calve in November or December. Tie them up in one shed, and feed them with normal grass for one or two weeks, accurately measuring the milk from each at every meal. Each cow to be provided with a tub, into which her eatables are placed, so that we may know if she consumes all that is provided for her.

During this time they will probably have settled down and become accustomed to their residence and companions, and we shall have made ourselves acquainted with their normal state, and any peculiarities they may have. Doses of ergotised grass are now to be given to, say, Nos. 1, 3, and 5; Nos. 2, 4, and 6 having during the whole period normal grass or hay, as far as can be ascertained. Nos. 1, 3, and 5 would have different doses administered at varying intervals; but the quantity and frequency of the doses we should mainly determine as the experiment proceeded. We should get an approximate weight of the ergot consumed, by detaching the visible spurs from a certain number of the spikes or panicles, say twenty or fifty, and weighing them. A strict register to be kept of each dose, and the time of its administration.

In the event of a cow or cows refusing to partake of all that is specially provided for her or them, it may be necessary to sprinkle it with meal or condiment, in which case the whole number would receive the same amount of meal or condiment, so as to prevent error as far as possible. If an experiment conducted on this principle succeeded, it would not only conclusively prove ergot (taken *per vias naturales*) to be capable of causing abortion in cows, but by allowing the animals aborting to remain with the others, infection and sympathetic influence would have an opportunity of asserting their power; and as all would be under similar circumstances with respect to the bull and water, these agencies would to a certain extent be put on their trial. Such an experiment, carefully and accurately carried out, is urgently needed to demonstrate to farmers that this malady can be and is frequently brought on by other agencies than injuries, infection, or sympathy, and might eventually lead to the discovery of an antidote.

But, thanks to our "Humane Vivisection Act," I have been gravely assured by those who know the law better than I do, that I could not perform this very simple experiment without getting a license for myself and premises,—to obtain which involves a great amount of trouble and annoyance, as all particulars of the proposed experiment, the reasons for so doing,

and the results likely to be obtained, have to be drawn up in a memorial, which must be signed by the President of this and that Society. Such a memorial must then be presented to the Secretary of State, who may or may not then graciously allow me "to intentionally give to animals a substance of which they frequently partake in their daily food." In fact, I am by no means certain that I did not render myself liable to a prosecution under the Act when I advised the owner to try the experiment of keeping the animals closely confined indoors, for had it been the infectious malady it is generally considered to be, I should thereby have caused animals to suffer which might have escaped. If M. Pasteur had been so hampered, we should have no remedy for hydrophobia. This law unfairly handicaps Englishmen with foreigners in scientific pursuits.

Should one or more of my readers desire to have this or a similar experiment carried out, I should be happy to co-operate with them; but the expense involved would be too much for me to incur singlehanded, especially as my pecuniary interest in the subject is limited to one cow which has not aborted.

Remedial Measures.

Innumerable nostrums have been tried and found wanting. Witchcraft and a species of homœopathy are the only remedies in which much faith has been placed. One farmer, with whom I am well acquainted, believed that the malady was stayed in his herd by burying an aborted calf under the lintel of the cowshed door. Another old gentleman writes to me advising the efficacy of boiling the forequarters of the aborted calf, and giving to each in-calver a pint of the broth, "to destroy the smell or *smit*." Others of a similar nature have been communicated to me "on the quiet," so that I am not sure that this sort of thing is not more often practised than published. When the premonitory symptoms have set in, I know of no drug capable of acting as an antidote, though if this subject is studied as I consider its importance demands, I have every reason to believe such an antidote might be discovered capable of neutralising the effect of ergot; but bearing in mind that one such case went her full time when kept from the possibility of obtaining more ergot, it would at all times be wise when such symptoms arise to adopt similar measures. If the cow is out, either bring her in or remove her to another pasture. If she is in, either change her hay or substitute straw for it. I do not expect such treatment to be often efficacious, but as it was so in one instance it may be so in others, and it does not entail much trouble or expense.

As a prophylactic or preventive for the remaining cows,

where cases have already taken place in a herd, removal from ergotised pastures or withdrawal of hay so affected, have in all cases, where it has been effectually carried out, proved successful. I would strongly urge every farmer, in the event of his having one or more animals (whether cows, sheep, or others) abort, carefully to examine all the articles of provender of which they are now or have lately been partaking.

If such cases take place from September to December, whilst the animals are out, and are caused by ergot, such should readily be discovered in the pastures.* When seeking for this article, first direct your attention to the sheltered places, under trees, hedges, &c., especially the north side of such (that is, the south side of the field); if not found there, go conscientiously over the whole pasture. I give this advice from experience, as in one instance I failed to find it in its usual habitat; but when returning, I discovered a plentiful supply in the centre of the field. The explanation of which is, that the whole field was stiff clay, but the borders were so wet that nothing but bull-fronts or tufted hair-grass (*Aira cæspitosa*) grew there, and though Prof. Fream and others have found ergot on that coarse grass, I have not.†

In the remaining months it is not easy, under ordinary circumstances, to discern it in fields; nothing but a minute and persevering search on hands and knees can be successful, as it has then left its host and is among the short grass. I own that I have never been sufficiently enthusiastic to practise the latter procedure.

If ergot should be found in a pasture, I would advise the farmer, first of all, to mark the portions of the field where it

---

* A word of warning may be useful in similar circumstances to the following, which have occurred to myself. Animals have aborted in certain pastures during spring and summer, seasons when ergot is not discernible, if present; in such cases, if ergot be the cause, we should naturally expect to see it growing freely in such pastures in the following autumn. As a rule, I think it will be so found, but not always. Take the past season, for example; in this neighbourhood we had little or no rain from the commencement of June till the middle of July, the first fortnight of the latter month being intensely warm. As a consequence, the pastures were eaten *very* bare, and probably many of last year's ergots which had fallen to the ground were eaten with the grass. When the rain came, there were fewer ergots to germinate than usual, and many of those that germinated might have failed to propagate their species from the absence of suitable hosts, namely, grasses in flower. I have visited many pastures where ergot was growing abundantly at this season last year, and now it is difficult to find a specimen, there being scarcely a grass in seed to be found in them, except crested dog's-tail (*Cynosurus cristatus*), on which I have not yet found ergot. Under such circumstances, if we find but a small quantity of this fungus present in itself insufficient to be injurious to animals, especially if that small quantity be found in various parts of the field, we may, I think, conclude that it is highly probable it was present in greater abundance the previous year.

† I have, since writing the above, found ergot in *Aira cæspitosa*.

occurs, by stakes or otherwise; then, and not till then, to carefully pick off all affected stems and burn them, and for the following two seasons at least never to allow a grass to flower on such portions, by mowing them frequently. This may appear a tedious and troublesome mode of procedure, but in reality it entails no more expense than would accompany a single cow aborting on an ordinary sized farm, and is, so far as I know, the only effectual method of eradicating this pest.*

In hay, ergot is not so easily discernible when present, from the fact of its occurring in patches. A long and tedious examination of a stack of hay may fail to reveal its presence; for, unless the hay was mown *very* late, the fungus could not have attained sufficient length to extrude much beyond the pales. But I would strongly advise a conscientious search for ergot, especially where some of the hay consumed by the animals aborting was made late. I have no doubt that such a search will be frequently unsuccessful, even when ergot is present in considerable quantities, as from the habit of growing in patches, it similarly occurs to a certain extent in the stack. I can easily understand a whole cutting being carefully examined, which takes more time than would generally be supposed by those who have not practised such an examination, and no ergot being found, whilst the next cutting might contain large quantities; so that I should not feel justified, if I had spent three or four hours in examining a late-made stack and found no ergot, in saying that none was present. I should take every available opportunity of renewing the search, and should try so to interest the man whose duty it was to feed such animals (by fee or otherwise), to examine every truss, and to save any suspicious spikes for my inspection.

In conclusion, I may mention that I shall be glad to hear from any agriculturist whose herd may suffer from this malady, and to give them any advice I can on the subject. I hope to continue my enquiries, and shall be glad of the co-operation of all who have recently experienced a loss from this affection, by receiving from them particulars of each outbreak; for which purpose I shall be pleased to forward a copy of the questions which I have arranged.

I have for obvious reasons abstained from going too minutely into the peculiar properties of ergot in a non-medical journal. To those unacquainted with its powers, I would advise a conversation with their medical man, who, I presume, would have no objection to impart any information as to the capabilities of the drug, if he was aware of the object of such enquiries.

* Or the pasture might be converted into a meadow, and mown moderately early for a couple of seasons.

My thanks are due to Mr. Toope, V.S., Mr. W. Crossland (late of the Downton College of Agriculture), and P. Inchbald, Esq., of Fulwith Grange, Harrogate, for the assistance and encouragement they have given me in these investigations.

If what I have written should be the means of inducing farmers to enquire into and make a note of all circumstances arising in connection with an attack of this or any kindred malady, one of my objects aimed at will have been attained.

XVII.—*Report on the Experiments on Ensilage conducted at Crawley Mill Farm, Woburn*, 1884–5, *and* 1885–86. By Dr. J. AUGUSTUS VOELCKER, B.A., B.Sc., Consulting Chemist to the Society.

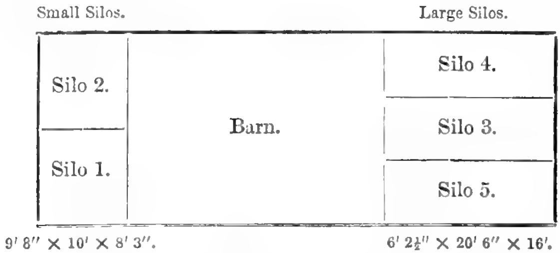
THE increasing attention given to the subject of ensilage and the absence until recently of any trustworthy records of properly conducted experiments to test the value of silage, both scientifically by chemical research and practically by feeding experiments, induced the Royal Agricultural Society of England to commence a series of investigations, of which the following is a record, so far as they have proceeded.

Involving, as an inquiry of this kind would, the erection of silos, and many attending expenses, the cost at starting was very considerable; and once more it is to the kindness of the Duke of Bedford, who bore the entire cost of erecting the silos, that the carrying out of the experiments is due.

The experiments were begun in 1884 under my father's direction, and continued just after his death by a special Committee of the Society, which was appointed for the purpose, and to which much assistance was rendered by Sir John Lawes. A large barn at Crawley Heath Farm was given by the Duke of Bedford for making the silos. The silos were erected on the brick flooring of the barn, and were thus entirely above ground. The barn was about 21 feet wide, and of considerable length. The right-hand end was divided by the raising of nine-inch brick walls into three silos, each 6 feet 2½ inches wide, 20 feet 6 inches deep horizontally, and 16 feet high, reaching nearly to the roof; and the left-hand end by similar walls into two silos, each 9 feet 8 inches wide, 10 feet deep, and 8 feet 3 inches high. The bottom and sides were carefully lined with cement, and each had a doorway open down to the floor, about 4 feet wide, arranged to be closed with boards right up to the top.

There was no special drain cut for any of the silos, but any liquid flowing from under the boarded doorway of silos 3, 4,

and 5, could pass into a gutter running just outside the front of the silos, and collect in a well. The boards used for closing the doorways had the edges cut in a jointed manner, so as to fit into those of the next above; so also were the edges of the boards used for placing on the top of the material when pressure was applied. The necessary pressure was applied either by means of sand resting on matting (without boards), or by stones placed in large elm boxes, which rested on the boards mentioned before. The amount of pressure was one cwt. per square foot. The temperatures of the barn and of each silo at three different depths, viz., one foot (front), two feet (back), and four feet (centre), were daily recorded for a considerable time; iron tubes, pierced with holes, being driven into the mass of silage to the respective depths, and a thermometer lowered into each.



The building of the silos was commenced about the middle of June, and they were dry and ready to be filled by July 17th, 1884.

First Year's Experiments, 1884–5.

The experiments for 1884–5 were intended to be on grass, clover, and oats converted into silage, and the silos were filled as follows:—

Silo 1 (small), filled on July 17th, 1884, with 5 tons 9 cwt. of whole grass, weighted at once with stones in boxes, weight 5 tons, resting on boards.

Silo 2 (small), filled on July 18th with 5 tons 13½ cwt. of whole grass, weighted on July 21st with 1 foot of sand, weight 5 tons, resting on matting, without boards.

Silo 3 (large), filled on July 23rd with 18 tons 3 cwt. of oats, cut green, and chaffed, weighted at once with stones in boxes, weight 6 tons, resting on boards.

Silo 4 (large), filled on July 25th with 12 tons 15 cwt. of unchaffed clover, weighted at once with 1 foot of sand, weight 6 tons, resting on matting, without boards.

Silo 5 (large), filled on July 28th with 17 tons 5 cwt. of

chaffed clover, weighted at once with stones in boxes, weight 6 tons, resting on boards.

In the feeding experiments of this year, the contents of Silos 1, 2, and 4 were employed. The grass for filling Silos 1 and 2 was taken from Crawley Heath; it was rather dry and overripe, but was the best procurable at the time the silos were ready for being filled. An analysis of an average sample of it gave its composition:—

Moisture	59·64
Soluble albuminoids	·31
Insoluble albuminoids	1·94
Digestible fibre	16·43
Woody fibre	14·45
Chlorophyll, soluble carbo-hydrates, &c.	4·64
Soluble mineral matter	1·47
Insoluble mineral matter	1·12
	100·00
Total nitrogen	·39
Albuminoid nitrogen	·36
Non-albuminoid nitrogen	·03

Of another lot of this grass hay was made, and an analysis of it gave the following results:—

Moisture	19·07
*Albuminoids	7·01
Digestible fibre	34·40
Woody fibre	24·76
Mineral matter	5·63
Carbo-hydrates, &c.	9·13
	100·00
* Containing nitrogen	1·12

This hay was, after chaffing, used in the feeding experiments. The grass, when cut, was carted to a weighbridge, weighed, and put into the Silos No. 1 and No. 2. It was, during the time of filling, stamped down and pressed in by several men and boys. The filling of No. 1 was completed in a single day, July 17th, and weights were applied at once. No. 2 was filled on July 18th, but not weighted until July 21st. The record of temperatures was taken daily for two months, and then once a week; some of these are given in the first Table on p. 486, the temperatures being in each case given on the Fahrenheit scale.

The clover used for filling silos 4 and 5 was brought from Houghton Park near Ampthill, some five miles off, none being procurable in the vicinity of the silos. This was carted to the weighbridge, weighed, and put into the silos, No. 4 being filled with the whole clover, but No. 5 with clover after passing

Date.	Temp. of Barn.	Silo 1, Grass.			Silo 2, Grass.		
		Centre, 4 ft.	Back, 2 ft.	Front, 1 ft.	Centre, 4 ft.	Back, 2 ft.	Front, 1 ft.
1884.	°	°	°	°	°	°	°
July 19 ..	63	82	91	111	81	88	108
„ 20 ..	67	84	96	106	85	104	125
„ 21 ..	64	85	95	105	88	105	110
„ 22 ..	65	86	96	109	87	105	108
„ 23 ..	67	88	96	107	91	104	106
„ 24 ..	64	92	95	98	93	106	102
„ 25 ..	60	94	89	96	89	98	96
„ 26 ..	60	87	92	98	94	101	94
„ 30 ..	68	88	90	95	94	97	90
Aug. 9 ..	74	85	87	91	93	95	90
„ 23 ..	68	85	85	86	90	94	85
„ 30 ..	63	82	83	82	88	91	80
Sept. 27 ..	58	76	75	78	85	90	78
Oct. 25 ..	46	69	68	72	81	85	72
Nov. 29 ..	38	63	61	60	76	80	61

through a chaffing-machine. No. 4 was filled on the 25th July, and No. 5 on the 28th July, the contents being rammed in in the same way as the grass, and weighted in each case on the day of filling. Analyses of average samples of the clover put in these silos gave the following results:—

	Silo 4. Clover (un-chaffed) July 25th.	Silo 5. Clover (chaffed) July 28th.
Moisture	73·50	78·73
Soluble albuminoids	·27	·51
Insoluble albuminoids	2·75	2·43
Digestible fibre	7·36	6·99
Woody fibre	9·57	6·52
Chlorophyll, soluble carbo-hydrates, &c.	4·47	2·90
Soluble mineral matter	1·30	·67
Insoluble mineral matter	·78	1·25
	100·00	100·00
Total nitrogen	·53	·57
Albuminoid nitrogen	·48	·47
Non-albuminoid nitrogen	·05	·10

The following was the analysis of the clover-chaff used in the subsequent feeding experiments:—

Moisture	16·47
*Albuminoids	16·62
Woody fibre	22·83

* Containing nitrogen .. .. 2·66

The record of temperatures was taken as in the case of the other silos; the principal are appended:—

Date.	Temp. of Barn.	Silo 4 (Unchaffed Clover).			Silo 5 (Chaffed Clover).		
		Centre, 4 ft.	Back, 2 ft.	Front, 1 ft.	Centre, 4 ft.	Back, 2 ft.	Front, 1 ft.
1884.	°	°	°	°	°	°	°
July 26 ..	60	78	85	91	..	..	..
„ 28 ..	65	85	91	89	..	..	..
„ 29 ..	66	85	90	84	76	83	84
„ 30 ..	68	86	89	84	76	76	87
Aug. 1 ..	75	88	87	83	79	81	86
„ 2 ..	72	87	85	82	78	81	84
„ 9 ..	74	88	84	81	82	84	84
„ 23 ..	68	87	83	80	82	81	79
„ 30 ..	63	83	79	76	81	77	76
Sept. 27 ..	58	76	74	71	74	72	69
Oct. 4 ..	53	73	72	68	75	70	66
„ 25 ..	46	68	67	63	68	64	62
Nov. 29 ..	38	63	60	58	64	58	56

During the interval from the time of filling to that of opening the silos it was observed that from Nos. 1 and 2 (filled with grass, which, as mentioned before, was rather dry), no liquid at all ran out, but from the other two, and especially No. 5 (chaffed clover), a good deal of liquid drained away, running out from under the boards forming the doorway. The smell of the liquid was very objectionable. By the end of September No. 4 had sunk two-thirds of its depth when full, and No. 5 one-half. Nos. 1 and 2 had not sunk so much.

Dr. Voelcker's death early in December, 1884, unfortunately caused a vacancy in the management of the experiments, and a special Committee of the Society was chosen to carry them on until the appointment of a successor. On January 8th, 1885, silo No. 1 was opened. Upon removing the weights and boards the silage was found to be mouldy about 6 inches from the top, the entire height of the silage being 5 feet. By the boarded doorway the mould penetrated fully 18 inches inwards, while at the cemented sides only about two or three inches were bad.

Eight two-year-old Shorthorn bullocks had been selected, and were divided into two sets of four each, all eight having for some time previously been kept upon the same food.

It had been decided that the question which the experiment should aim at answering was to be, "Will bullocks fatten as well on silage as on a mixture of roots and hay-chaff?" The importance of this proposition needs no lengthy explanation. The necessity of a succulent food of some kind for winter keep is

universally recognized, as is the difficulty in many districts of growing roots to supply this want; and also the uncertainty, in variable seasons and with adverse climates, of converting grass or clover into good hay. Practically the question might be put thus: "Will the farmer who is unable to grow profitably, or procure at a reasonable price, roots to mix with hay-chaff as a winter food of a succulent nature, find an equally good or a better substitute for both in silage?" Or, again, "Will the farmer who, on account of bad weather or unsuitable climate, is unable to make good hay, find that by the system of ensilage he is yet able to save his crop of grass or clover and, independently of the weather, ensure a valuable supply of succulent food for winter keep?"

The foods decided on for the two sets were:—

Set 1.	*Set* 2.
Decorticated cotton-cake.	Decorticated cotton-cake.
Maize meal.	Maize meal.
Hay-chaff.	Grass silage.
Swedes.	

As this was the first experiment of the kind, and it was not known how the bullocks would take to the silage, or what quantities they would eat, an experimental period, January 12th to January 29th, was taken to determine these points. During this period several changes and substitutions had to be made owing to some of the bullocks not taking well to the food; but finally eight settled down well, and were weighed on January 29th as follows:—

To receive Roots and Hay-chaff.		To receive Silage.	
	cwts. qrs. lbs.		cwts. qrs. lbs.
No. 1	9 2 0	No. 5	9 1 2
No. 2	9 3 0	No. 6	9 3 14
No. 3	10 0 21	No. 7	10 0 7
No. 4	9 0 0	No. 8	8 1 12
	38 1 21		37 2 7

It may be mentioned here that the weighings were always taken at the same hour, viz. 9 A.M., three hours after the first feeding.

In determining the quantities of the various foods, the Committee were much aided by Sir John Lawes, who in a memorandum gave his views and recommendations as to the carrying out of the proposed experiment. The main points of this memorandum, based upon his own experiences at Rothamsted, were as follows:—

1. That the two sets of foods to be compared should agree

with each other in regard to some of their most important constituents, the proportions of dry matter, woody fibre, and nitrogen, being specially mentioned as the base of calculations.

2. That the purchased food should be the same in each experiment, and not so large in quantity as to exert too great an influence upon the increase of the animals; if cake and meal were used, about 6 lbs. per head daily of the mixture should be sufficient.

3. That if grass silage be used, the parallel experiment should be with meadow hay; if clover silage, then with clover hay.

The Committee decided to carry out the experiment on the lines of Sir John Lawes's recommendations, using for the bullocks, per head per day, 3 lbs. of decorticated cotton-cake and 3 lbs. of maize-meal, in addition to which four bullocks were to receive a mixture of swedes and hay-chaff, and the other four only silage, the quantities to be arranged after analysis of the different foods, so that the amounts of dry substance, woody fibre, and nitrogen should be as nearly as possible equal in the silage and in the mixture of roots and hay-chaff.

Analyses were made by me of the silage taken from silo No. 1, of the swedes, and of the hay-chaff and other foods. The essential constituents, as decided on for the regulation of the quantity of food, were—

	Dry Matter.	Woody Fibre.	Nitrogen.
	per cent.	per cent.	per cent.
Silage	35·94	11·35	·55
Swedes	11·33	1·11	·24
Hay-chaff ..	80·93	24·76	1·12

Calculating upon these data, the following arrangement of the food was, after careful consideration, decided upon as the most suitable for the purpose of comparative experiment :—

		Dry Matter.	Woody Fibre.	Nitrogen.
	lbs.	lbs.	lbs.	lbs.
Silage	35	12·57	3·97	·192
Swedes	50	5·66	·55	·12
Hay-chaff ..	9	7·28	2·23	·10
		12·94	2·78	·22

It will be readily understood that the above was taken merely as a standard which should be aimed at, and which would have to be regulated by circumstances: 50 lbs. of swedes and 9 lbs. of hay-chaff per head daily were quantities which, with the daily allowance of cake and corn, would be considered by practical men as suitable for fattening bullocks such as those at Woburn; and the intention was, by taking this result obtained by practice, to combine with it the chemical or scientific features of feeding, and in dealing with a fresh kind of food, aim at supplying to the animals receiving silage as nearly as possible the same amounts of dry matter, woody fibre, and nitrogen as were practically known to constitute good feeding in the case of swedes and hay-chaff.

It should be mentioned, too, that the silage was not uniform in quality throughout, being wetter in some portions, especially as it got nearer to the floor of the silo; and this involved a succession of analyses and readjustment of the quantities of silage according as wetter or drier portions were cut.

The bullocks were accordingly fed with the quantities of food determined upon, viz.:

Bullocks 1, 2, 3, 4 per head daily:
- 3 lbs. Decorticated cotton-cake.
- 3 „ Maize meal.
- 50 „ Swedes.
- 9 „ Hay-chaff.

Bullocks 5, 6, 7, 8 per head daily:
- 3 lbs. Decorticated cotton-cake.
- 3 „ Maize meal.
- 35 „ Silage.

The bullocks all ate their food well, those receiving silage drinking a large quantity of water. The dung of the silage animals was of a dark brown colour, and much firmer than that of the others.

On February 19, Silo No. 1 being all but finished, the bullocks were re-weighed.

Receiving Roots and Hay-chaff.

	Jan. 29.			Feb. 19.			Increase in 3 weeks.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwt.	qrs.	lbs.
1	9	2	0	10	0	14	0	2	14
2	9	3	0	9	2	9	loss		19
3	10	0	21	11	0	0	0	3	7
4	9	0	0	9	2	23	0	2	23
Total ..	38	1	21	40	1	18	1	3	25

Receiving Silage.

	Jan. 29.			Feb. 19.			Increase in 3 weeks.	
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	qrs.	lbs.
5	9	1	2	9	1	14	0	12
6	9	3	14	9	3	0	loss	14
7	10	0	7	10	2	14	2	7
8	8	1	12	8	3	4	1	20
Total ..	37	2	7	38	2	4	3	25

Gain per head daily—On roots and hay-chaff, $2\frac{3}{4}$ lbs.; on silage, $1\frac{1}{4}$ lb.

FOOD consumed from JAN. 29 to FEB. 20 (23 days).

			Daily average per head
		lbs.	lbs.
By bullocks 1, 2, 3, 4	Swedes	4597	50
	Hay-chaff	788	9
	Decorticated cotton-cake ..	276	3
	Maize meal	276	3
By bullocks 5, 6, 7, 8	Silage	3826	$41\frac{1}{2}$
	Decorticated cotton-cake ..	276	3
	Maize meal	276	3

Silo No. 2 was opened on February 19th, as stated. On shovelling the sand back and cutting into the material, $1\frac{1}{2}$ inch of mould was found, then for 7 inches there was slight mouldiness; at 11 inches the silage was perfectly good, and had a decided butyric aroma. At the doorway the silage was bad for 1 foot down and 15 inches inwards; at the walls the mould did not penetrate at all, but did from the top surface to the depth of 16 inches.

Analyses of the silage and of the mangolds now to be used (instead of swedes) were made, and showed :—

	Dry Matter.	Woody Fibre.	Nitrogen.
	per cent.	per cent.	per cent.
Silage	39	11·95	·54
Mangolds ..	9·83	·68	·24

and the foods were accordingly arranged :—

		Dry Matter.	Woody Fibre.	Nitrogen.
	lbs.	lbs.	lbs.	lbs.
Silage	32	12·48	3·82	·173
Mangolds ..	50	4·92	·34	·12
Hay-chaff ..	9	7·28	2·23	·10
		12·20	2·57	·22

The bullocks recommenced feeding well, but after a week was over the silage animals seemed to tire somewhat of their food. They, however, did better after this, and so continued till the first part of the experiment concluded on March 30th. No. 2 of the root-fed bullocks also became very loose and lost weight; but when his supply of water was cut off, he went up rapidly in weight again.

The bullocks feeding on roots drank on an average 18 lbs. of water each daily; those on silage, 55 lbs., or over three times as much. Weighings were taken on March 2nd, 16th, 30th.

The successive weights during the whole period were—

Receiving Roots and Hay-chaff.

	Jan. 29.			Feb. 19.			March 2.			March 16.			March 30.			Increase in 60 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cts.	qrs.	lbs.
1	9	2	0	10	0	14	10	19	0	10	2	12	10	3	15	1	1	15
2	9	3	0	9	2	9	9	2	0	10	1	18	10	3	7	1	0	7
3	10	0	21	11	0	0	11	0	13	11	1	14	11	2	4	1	1	11
4	9	0	0	9	2	23	9	3	16	10	0	18	10	0	26	1	0	26
Total ..	38	1	21	40	1	18	40	3	10	42	2	6	43	1	24	5	0	3

Receiving Silage.

	Jan. 29.			Feb. 19.			March 2.			March 16.			March 30.			Increase in 60 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cts.	qrs.	lbs.
5	9	1	2	9	1	14	9	1	7	9	2	7	9	1	26	0	0	24
6	9	3	14	9	3	0	9	2	21	9	3	16	10	0	16	0	1	2
7	10	0	7	10	2	14	10	2	13	10	3	17	11	0	16	1	0	9
8	8	1	12	8	3	4	8	3	0	8	3	12	8	3	2	0	1	18
Total ..	37	2	7	38	2	4	38	1	13	39	0	24	39	2	4	1	3	25

	Jan. 29 to Feb. 19.	Feb. 19 to March 2.	March 2 to March 16.	March 16 to March 30.
Gain per head daily:	lbs.	lbs.	lbs.	lbs.
With roots and hay-chaff ..	$2\frac{3}{4}$	$1\frac{1}{11}$	$3\frac{1}{2}$	$1\frac{9}{11}$
With silage	$1\frac{1}{4}$	loss. $\frac{5}{11}$	$1\frac{5}{7}$	$\frac{3}{5}$

Or over the total period of 60 days:—

Gain per head daily, with roots and hay-chaff .. .. $2\frac{1}{3}$ lbs.
" " with silage .. .. $\frac{11}{12}$ lb.

The bullocks 1, 2, 3, 4, ate on an average 50 lbs. of mangolds, 8 lbs. of hay-chaff, 3 lbs. of cake, and 3 lbs. of meal. Bullocks 5, 6, 7, 8, the same cake and meal, and on an average 30 lbs. of silage, though 32 lbs. would have been their full allowance had they been able to consume it.

The experiment being so far concluded, it was decided next to reverse it, giving silage to the animals which had been fed on roots and hay-chaff, and *vice versâ*. At the same time, Silos 1 and 2 having been finished, No. 4 (unchaffed clover, weighted with sand) was begun, clover-hay being also used. Silo 4 was opened on April 2nd; the silage was far wetter than that of Silos 1 or 2, and had a distinctly acid smell, not at all pleasant; but it was of very fair quality. It did not seem in the least hot, the thermometer indicating only 58° F. By the doorway, mould penetrated from 3 to 8 inches; from the top surface downwards the silage was unfit for use for 6 to 8 inches, and at the sides from 3 to 6 inches. At the bottom, about 1 in. was of a much lighter colour, and had a very strong smell.

Analyses of the new foods were made by me, and gave the following results:—

	Dry Matter.	Woody Fibre.	Nitrogen.
	per cent.	per cent.	per cent.
Clover silage ..	20·23	6·56	·36
Clover hay ..	83·53	22·82	2·66

As it was found that the bullocks would not clean up more than 8 lbs. of the clover hay-chaff, the limit of foods was fixed thus:—

		Dry Matter.	Woody Fibre.	Nitrogen.
	lbs.	lbs.	lbs.	lbs.
Mangolds	50	4·92	·34	·12
Clover hay-chaff ..	8	6·68	1·82	·21
		11·60	2·16	·33
Clover silage	57	11·53	3·74	·205

On April 2nd the new experiment began, the bullocks being re-weighed. Very shortly, all took to 50 lbs. each daily of the silage, and the quantity was increased to 56 lbs.; but they would not eat this for more than two days, and then two of them left a few pounds; after that the quantities had to be somewhat reduced to get them to eat up all.

The remainder of the experiment calls for but few remarks; from April 20th right up to June 1st, when the experiment closed, the bullocks steadily ate as nearly as possible 50 lbs. of silage per head each day, with slight variations, except that during the cold weather of the middle of May they ate more freely than at any other time. The silage animals drank about twice as much water as the others. Weights were taken on April 20th, May 4th, May 18th, and June 1st, as follows:—

Receiving Clover Silage.

	April 2.			April 20.			May 4.			May 18.			June 1.			Increase in 60 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwt.	qr.	lbs.
1	10	3	20	10	2	0	10	3	7	11	0	0	11	1	22	0	2	2
2	10	3	19	10	2	8	10	1	7	10	2	14	11	0	10	0	0	19
3	11	2	21	11	2	4	11	2	14	11	3	19	12	0	8	0	1	15
4	10	1	7	10	1	21	10	1	14	10	1	16	10	1	16	0	0	9
Total ..	43	3	11	43	0	5	43	0	14	43	3	21	45	0	0	1	0	17

Receiving Roots and Clover Hay-chaff.

	April 2.			April 20.			May 4.			May 18.			June 1.			Increase in 60 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cts.	qrs.	lbs.
5	9	1	18	9	3	7	10	0	0	10	1	10	10	2	16	1	0	26
6	10	0	0	10	1	21	10	2	0	10	2	17	11	0	0	1	0	0
7	11	0	7	11	0	0	11	3	12	11	3	16	12	0	15	1	0	8
8	8	2	8	8	2	21	8	3	16	9	1	6	10	0	0	1	1	20
Total ..	39	0	5	39	3	21	41	1	0	42	0	21	43	3	3	4	2	26

	April 2 to April 20.	April 20 to May 4.	May 4 to May 18.	May 18 to June 1.
Gain per head daily:	lbs.	lbs.	lbs.	lbs.
With roots and clover-hay ..	$1\frac{1}{3}$	$2\frac{1}{2}$	2	$3\frac{2}{11}$
With clover-silage	loss. $1\frac{1}{4}$	loss. $\frac{1}{6}$	$1\frac{7}{11}$	$2\frac{1}{8}$

Over the whole period of 60 days:—

Gain per head daily, with roots and clover hay .. $2\frac{1}{5}$ lbs.
" " with clover silage .. .. .. $\frac{1}{2}$ lb.

The root-fed animals throughout the whole period consumed daily 50 lbs. of mangolds per head, 3 lbs. of decorticated cotton-cake, 3 lbs. of maize meal, $7\frac{1}{2}$ lbs. of clover hay-chaff, and drank 15 lbs. of water on an average.

The silage-fed animals had the same cake and meal, and on an average 46 lbs. of silage and 28 lbs. of water each daily.

The first year's experiments ceased on June 1st, having lasted four months. There are many points, such as the cost of construction of the silos, of filling and emptying them, &c., with which our inquiry was not directly concerned, but which are, to the practical farmer, matters of great importance. Our aim in the present case was to test, by the carrying out of a practical experiment, the relative feeding value of silage as compared with roots and hay-chaff. The evidence of the experiment shows distinctly in favour of the latter; the simple facts being, that from the very beginning, the animals which were fed on roots and hay-chaff continued with one, and that only a temporary, exception, to gain fast and steadily, showing an average daily increase per head during the different periods of $2\frac{3}{4}$ lbs., $1\frac{1}{11}$ lbs., $3\frac{1}{2}$ lbs., $1\frac{9}{11}$ lbs.; while the silage-fed animals showed in the same periods: gain, $1\frac{1}{4}$ lbs.; loss, $\frac{5}{11}$ lb.; gain, $1\frac{5}{7}$ lbs.; gain, $\frac{3}{5}$ lb.; or for the whole two months a daily gain per head of $2\frac{1}{3}$ lbs. on roots and hay-chaff, as against $\frac{11}{12}$ lb. on silage. Then, when the experiment was reversed, those bullocks which had previously shown so comparatively small an increase with silage, gained $1\frac{1}{3}$ lbs., $2\frac{1}{2}$ lbs., 2 lbs., and $3\frac{2}{11}$ lbs. per head daily when their food was changed to roots and hay; but those which before had done so well on roots, on having silage instead, at first lost $1\frac{1}{4}$lbs., then lost $\frac{1}{6}$ lb.; then gained $1\frac{7}{11}$ and $2\frac{1}{8}$ lbs. per head daily; or for the full period of two months, the daily gain per head on roots and hay-chaff was $2\frac{1}{5}$ lbs., on silage, $\frac{1}{2}$ lb.

In summing up, it is to be remembered that this was the first

year's experiment in the making of silage at Woburn, and that the grass which was used both for making hay and silage was not in a condition nor of a quality likely to produce really good silage. I am therefore not prepared to take the experiments of a single year as decisive. Nevertheless, the experiments have undoubtedly shown this: that inferior grass, such as I must call this, will never make a food at all able to compare in feeding-value with roots and hay containing as nearly as possible the same amount of essential feeding-constituents, even if the hay be made from the same grass as the silage. The clover was, however, thoroughly good; and with it, too, the same feeding result was obtained. I have abstained from going into the question of the chemical losses sustained during ensilage, having myself only taken in hand these experiments a considerable time after their commencement; but I hope to do this in a future year.

Silos 1, 2, *and* 4.—Silo 1 was intended for "sour" silage, and Silo 2 for "sweet" silage; but, as the appended analyses show, the distinctions could not be traced, nor was there anything like uniformity among the different samples taken from the same silo. It is probable that in Silo 2, though the temperature rose higher than in Silo 1, it was never high enough throughout the entire mass to render it what is termed "sweet" silage. The dry state of the grass also had in all likelihood much to do with the imperfect souring of No. 1. No. 4 silo, on the other hand, the material of which was much wetter, was decidedly acid, and the temperature did not go above 91° F. This silage kept very much longer free from mould than either of the others, they turning soon bad. On cutting out some of the silage and inserting a thermometer in the mass, it registered 120° to 130° F. in the case of Silos 1 & 2, but only 58° F. with that of Silo 4, the silage keeping quite cool. A cubic foot from No. 1 weighed 22 lbs., from No. 2, 16 lbs., and from No. 4, 38 lbs.

The following Table represents the weights put in and removed:—

	Silo 1.				Silo 2.				Silo 4.			
	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.	tons.	cwts.	qrs.	lbs.
Grass put in	5	9	0	0	5	13	2	0	12	15	0	0
Silage removed (good and bad)	4	16	1	25	4	8	0	5	10	0	2	15
Loss by evaporation, fermentation, drainage, &c. ..	0	12	2	3	1	5	1	23	2	14	1	13
	or 11·5 per cent.				or 22 per cent.				or 21 per cent.			

ANALYSES of SAMPLES of the THREE SILOS.

SILO 1.

	Centre of Silo, 1 ft. from surface.	3 ft. from surface, 1 ft. 6 in. from side.	Average of 2 to 3 ft. from top.	Average of lowest, 2 ft.	Bottom.
Moisture	64·06	75·27	69·33	74·22	77·40
Soluble albuminoids	·24	·33	·42	·37	..
Insoluble albuminoids	1·88	·85	·88	·73	..
Digestible fibre	13·46	8·89	10·76	9·22	..
Woody fibre	11·35	8·00	10·56	8·48	..
Volatile acids (reckoned as acetic acid)	..	·08	·13	·51	..
Fixed acids (reckoned as lactic acid)	·22	·34	·36	·17	..
Soluble carbo-hydrates, chlorophyll	6·01	3·95	5·03	3·88	..
Soluble mineral matter	1·33	1·16	1·45	1·47	..
Insoluble mineral matter	1·45	1·13	1·08	·95	..
	100·00	100·00	100·00	100·00	..
Total nitrogen	·55	·31	39	·32	..
Albuminoid nitrogen	·34	·19	·21	·18	..
Non-albuminoid nitrogen ..	·21	·12	·18	·14	..

SILO 2.

	Centre of Silo, average of 1–2 ft. from top.	2 ft. from back wall, average of 1–2 ft. from bottom.	Bottom of Silo.
Moisture	61·00	56·40	74·20
Soluble albuminoids	·63	·44	..
Insoluble albuminoids	1·12	1·44	..
Digestible fibre	15·84	17·11	..
Woody fibre	11·95	13·98	..
Volatile acids (reckoned as acetic acid) ..	·20	..	..
Fixed acids (reckoned as lactic acid)	·61	·65	..
Soluble carbo-hydrates, chlorophyll, &c. ..	5·62	6·65	..
Soluble mineral matter	1·63	1·90	..
Insoluble mineral matter	1·40	1·43	..
	100·00	100·00	..
Total nitrogen	·54	·61	..
Albuminoid nitrogen	·28	·31	..
Non-albuminoid nitrogen	·26	·30	..

Silo 4.

Moisture	79·77	81·08
Soluble albuminoids	..	·41
Insoluble albuminoids	..	1·06
Digestible fibre	..	4·74
Woody fibre	6·56	6·75
Volatile acids (reckoned as acetic acid)	·37	·18
Fixed acids (reckoned as lactic acid)	·36	·49
Soluble carbo-hydrates, &c.	..	3·16
Soluble mineral matter	..	1·36
Insoluble mineral matter	..	·77
		100·00
Total nitrogen	·36	·32
Albuminoid nitrogen	..	·24
Non-albuminoid nitrogen	..	·08

It would appear that with a material fairly succulent the production of sour silage is a comparatively easy matter, and that by putting on weights at once the temperature is kept down, and does not exceed 90° F., or so. As a material for weighting, sand spread on matting was not found to be so good as stones in boxes resting on boards, as whenever the silage settled unevenly the sand had a great tendency to fall together, and leave parts of the silage less protected from the entrance of air. In the feeding experiments only what was perfectly good was given to the bullocks.

Silos 3 *and* 5.—The accommodation at Crawley Mill Farm not allowing of more than a limited number of bullocks being experimented upon, and the season being already too far advanced, it was decided not to open Silo 3 (chaffed oats), but to let it stand over until another year, partly too with the object of seeing whether it would keep well so long. In the case of Silo 5 it was resolved to weigh out the entire contents at one time, instead of at intervals extending over two or three months, as had been done with the other silos, in order to ascertain the exact loss of weight by evaporation, fermentation, drainage, &c. This was done on July 1st, 1885, the temperature of the silage being then 60° F. to 64° F. in different parts. On opening the silo, the silage (chaffed clover) was found to be mouldy for from 2 to 4 inches below the surface. At the sides the mould penetrated, at a depth of 2 feet from the surface, for 6 to 8 inches inwards; but on coming lower down this extent was rapidly reduced, and at 4 feet depth the silage was good quite up to the wall. Just at

the bottom it was very wet, and had a strong and disagreeable smell.

	tons.	cwts.	qrs.	lbs.
Total weight put into Silo, July 28, 1884	17	5	0	0
Total weight of Silage removed, July 1, 1885	15	17	1	16
Loss by evaporation, fermentation, drainage, &c.	0	27	2	12

being 8 per cent. of the weight put in.

As the silage was being removed, samples of it were taken and an average one made, which gave on analysis—

Water	78·42
Nitrogen	·46
Ash	2·48

QUANTITY and COMPOSITION of the CLOVER put into SILO 5, and of the SILAGE taken out, with LOSS of CONSTITUENTS.

	Fresh.	Dry matter.	Nitrogen.	Crude nitrogenous substances.	Crude non-nitrogenous substances.	Dry organic.	Ash.	Water.
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Clover put in	38,640	8,219	220	1,375	6,102	7,477	742	30,421
Silage taken out	35,548	7,671	164	1,025	5,949	6,974	697	27,877
Loss ..	3,092	548	56	350	338	688	45	2,544
	PERCENTAGE LOSS IN FRESH.							
	8	1·4	·15	·93	·4	1·3	·12	6·6

Thus of the 8 per cent. total loss, 6·6 per cent. were of water.

SECOND YEAR'S EXPERIMENTS, 1885–86.

The experiments were this year confined to grass. Instead of using the inferior grass of Crawley Heath, as on the previous occasion, meadow-grass from a field belonging to Mr. Edward Blundell, of Birchmoor Farm, Woburn, was used, the field being one adjoining Stackyard Field. This grass was of a quality very greatly superior to that used the year before; and though it cannot be said that the herbage was of the finest character, its quality was certainly very fair, and quite as good as any to be obtained in that part of Bedfordshire. Two silos were employed, viz., Silos 1 and 4; the intention being to fill Silo 1 with grass to be converted into "sweet" silage, and Silo 4 with the same kind of grass, to be made into "sour"

silage. The experience of the previous year showed the undesirability of having the doorways of the silos boarded, so they had in the interval been bricked up to a considerable height, and carefully cemented on the inside. There was therefore no escape for any water or liquid that might be pressed out. The grass for the two silos was taken out of the same field, and simultaneously a third portion was made into hay; only as much grass as was required each time for carting was cut.

The grass was first cut on July 4, and on that day, 12 loads, weighing in all 10 tons 16 cwt. 3 qrs. 12 lbs., were put into Silo 4, while one load weighing 14 cwt. 2 qrs. 24 lbs., was put into Silo 1, and 6 loads, weighing 7 tons 6 cwt. 1 qr. 12 lbs., were carted into an adjoining meadow and made into hay. This latter was stacked on July 6, when it weighed 2 tons 11 cwt. 0 qrs. 21 lbs. Samples of each load were taken by myself as the silos were being filled, and were preserved for analysis. Silo 4 was weighted at the end of the day and left to settle. The single load in Silo 1 was only pressed slightly at the sides, and not at all in the centre, and was left unweighted.

On July 7, another load and a half, weighing 35 cwt. 2 qrs. 2 lbs. was added to Silo 1. On July 10, Silo 4 was reopened, and 4 loads more, weighing 4 tons 6 cwt. 1 qr. 4 lbs. were added, the whole being then again weighted with stones in boxes resting on boards, giving a pressure of 112 lbs. to the square foot. The total weight of grass in Silo 4 was thus 15 tons 3 cwt. 0 qrs. 16 lbs. On the same day another load of 22 cwt. 3 qrs. 19 lbs. was added to Silo 1, making a total of 3 tons 13 cwt. 0 qrs. 13 lbs. On July 16, six days later, the grass was weighted in the same way as in the case of Silo 4.

Both silos were opened on December 18, and the haystack was also cut, the feeding experiments beginning on that day.

The bullocks selected were 16 very nice 3-year-old Herefords, purchased at Northampton at 16*l.* 17*s.* 6*d.* per head, all coming from one herd. These had for a fortnight previously been feeding on 3 lbs. decorticated cotton-cake, 5 lbs. maize, 8 lbs. wheat-straw chaff, and 45 lbs. sliced swedes, per head daily. It had been suggested that 2-year-old animals were not so suitable for silage feeding experiments as older ones; there was an additional advantage in having Hereford cattle, as these in all our experiments at Woburn have proved much quieter and more kindly feeding and regular animals than Shorthorns. The experience of the previous year had taught me to observe several points to which attention was now given. In the first place, as mentioned already, I determined to use better grass, and hoped to make better silage; secondly, the exclusion of air, as

far as possible, seemed to be a necessity in order to prevent moulding, and hence the boarded doorways were removed and these bricked up, boards only being used as a kind of super-silo when a height was reached where filling from a cart would have been impracticable; thirdly, in making "sweet" silage, it was seen that much greater care and longer time in filling would be required than was given last year; lastly, weighting by stones in boxes resting on boards was decided on as a better plan than the use of sand resting merely on matting.

The following series of feeding experiments were carried out:—

1. Silo 4:—"Sour" Silage *v.* Roots and Hay-chaff.
2. Silo 1:—"Sweet" Silage *v.* Roots and Hay-chaff.
3. Silo 3 (1884):—Oat Silage *v.* Roots and Straw-chaff.
4. „ „ Oat Silage *v.* Hay.

The 8 feeding boxes were available, as also a shed capable of holding 4 bullocks, while the remaining 4 were kept in the open yard, a small part of which was covered.

First Experiment.—Sour Silage *v.* Roots and Hay-Chaff.

(*a.*) *Notes on Silo* 4.—In this experiment the silage used was that from Silo 4, filled as follows:—

1885.	tons.	cwts.	qrs.	lbs.
July 4:—12 loads weighing	10	16	3	12
„ 10:—4 „ „	4	6	1	4
Total	15	3	0	16

The weather on each day was fine. Each load was sampled as it was being put in the silo; the grass was trodden well by five men, especial care being taken with the corners and sides. The boards and weights were put on at the end of the day, the height of the contents being 12 ft. 7 in. Iron tubes were driven in to different depths, and thermometers let down into them registered at 1 ft. depth 68° F., at 2 ft. depth 76° F. By next morning the contents had sunk 4 ft. to 4 ft. 6 in., the temperatures being 78° F. at 1 ft., and 90° F. at 2 ft. On each of the mornings of the 6th and 7th the contents had sunk another 6 in., and on the latter day the boards and weights were removed, the temperatures recorded being 76° F. at 1 ft., 90° F. at 2 ft., and 90° F. at 4 ft. from the surface. The temperature of the barn was 65° F. The 4 ft. depth was in the centre of the silo, the 2 ft. at the back, and the 1 ft. at the front.

Four fresh loads were filled in on July 10. Willesden paper was spread over the top, then the boards, and finally the stones

in boxes resting on cross boards, the weight being 112 lbs. to the square foot. The temperatures were recorded, at first daily, but later on at intervals only. The principal ones are here given, all being stated on the Fahrenheit scale.

TABLE I.—RECORD OF TEMPERATURES IN SILO NO. 4.

Date.	Temperature of Barn.	Centre, 4 ft. deep.	Back, 2 ft. deep.	Front, 1 ft. deep.
1885.	°	°	°	°
July 4 ..	..	..	76	68
„ 5 ..	..	..	90	78
„ 6 ..	..	..	92	76
„ 7 ..	..	90	90	76
„ 8 ..	65	90	80	76
„ 9 ..	65	94	83	82
„ 10 ..	66	92	88	84
„ 11 ..	64	80	95	90
„ 13 ..	62	81	91	90
„ 14 ..	66	82	85	88
„ 15 ..	66	82	86	86
„ 20 ..	65	81	92	88
„ 30 ..	63	80	89	82
Aug. 8 ..	63	76	84	79
„ 24 ..	58	70	79	73
Sept. 2 ..	57	64	72	70
Oct. 2 ..	54	59	67	62
Nov. 2 ..	46	50	58	56
Dec. 17 ..	48	48	52	51
1886.				
Jan. 2 ..	49	44	50	73
Feb. 6 ..	33	40	50	..
„ 19 ..	33	32	70	..
Mar. 9 ..	34	..	57	..

The temperature, it will be noted, in no case went above 95° F.

The silo was opened on December 17. Before removing the weights the temperatures were :—51° F. at 1 ft., 52° F. at 2 ft., and 48° F. at 4 ft., that of the barn being 48° F. The Willesden paper was found to be in good preservation. There were 4 in. of surface mould, and at 2 ft. depth about 4 in. of mould at the sides. Where the silage remained in contact with the boards, above the bricked doorway, there was considerable waste, but hardly any when the lower and bricked portion was reached. On cutting the silage out it was quite cool, a thermometer put into the loose mass only registering 45° F. After the first portion had been cut out, the silage was found to be good right up to the wall. The cut surface would at times mould a little, especially in damp warm weather, and then a much higher temperature (98° F.) was reached. The very bottom part was wet and light in colour. The contents were taken out in

six different cuts, from December 18 to May 10, each being sampled, and everything weighed. One cubic foot weighed $30\frac{1}{4}$ lbs. This was really nice silage, not over acid at all, and was readily taken by the bullocks.

	tons.	cwts.	qrs.	lbs.
Total weight of Grass put into Silo 4	15	3	0	16
" " silage removed	14	6	2	8
Loss by evaporation, fermentation, &c. ..	0	16	2	8

Or about 5·5 per cent.

(*b.*) *Results of Feeding Trial.*—The question for solution was that of last year, viz., "Will bullocks fatten as well on silage as on a mixture of roots and hay chaff?" and the trial was carried out on the same lines as then. This being, so to say, the principal experiment, the eight feeding boxes were used for it, four bullocks being fed on cake, corn, roots, and hay, as against four with the same cake and corn, but having silage in place of roots and hay. The water supplied to the beasts was also always weighed. As mentioned before, the bullocks had been previously feeding on the quantities of cake, corn, and roots which they were intended to have in the experiment. They were selected and weighed on December 21, as follows :—

To receive Silage.				To receive Roots and Hay-chaff.			
	cwts.	qrs.	lbs.		cwts.	qrs.	lbs.
No. 1	10	0	18	No. 5	10	0	18
No. 2	10	0	4	No. 6	9	3	6
No. 3	11	3	16	No. 7	11	2	7
No. 4	10	1	22	No. 8	10	2	9
	42	2	4		42	0	12

Briefly, it may be said that both sets of animals continued in the most satisfactory way possible throughout the experiment. They took their foods kindly, kept in the best of health, and steadily increased in live-weight. This being so, the experiment was in every way a successful one. At commencing, the bullocks ate in the one case 45 lbs. of swedes and 11 lbs. hay chaff per head daily; in the other, 50 lbs. of silage, the cake and corn to each set being 3 lbs. decorticated cotton-cake and 5 lbs. maize-meal per head daily. These quantities of roots and hay, as also of cake and corn, were kept to throughout, the silage being given *ad libitum*, though weighed, the amounts varying somewhat according to the differences of moisture in different parts of the silo. 50 lbs. was the average daily amount for each

beast. It was a noticeable feature that the animals having silage drank far more water than those eating roots and hay—the average daily amount for each silage-fed animal being 39 lbs., and for each root-fed animal 19 lbs. Mangolds were substituted for swedes when the latter were no longer good. The whole period of experiment was 113 days, weighings being made on February 1, February 13, March 13, and finally on April 17, as follows:—

	Receiving Silage.															Total gain in live-weight in 113 days.		
	Dec. 21.			Feb. 1.			Feb. 13.			March 13.			April 17.					
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 1	10	0	18	11	1	5	11	0	8	11	2	0	12	0	18	2	0	0
No. 2	10	0	4	11	0	0	11	2	2	11	2	14	12	1	7	2	1	3
No. 3	11	3	16	12	2	8	13	0	3	13	1	14	13	3	3	1	3	15
No. 4	10	1	22	10	3	8	11	2	18	11	3	7	12	2	12	2	0	18
Total of 4 bullocks	42	2	4	45	2	21	47	1	3	48	1	7	50	3	12	8	1	8

	Receiving Roots and Hay-chaff.															Total gain in live-weight in 113 days.		
	Dec. 21.			Feb. 1.			Feb. 13.			March 13.			April 17.					
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 5	10	0	18	11	1	14	11	1	23	11	2	19	12	2	2	2	1	12
No. 6	9	3	6	10	2	3	10	3	0	11	1	0	11	3	6	2	0	0
No. 7	11	2	7	12	1	10	12	2	0	13	0	3	14	0	0	2	1	21
No. 8	10	2	9	11	1	7	11	2	0	11	3	26	13	0	7	2	1	26
Total of 4 bullocks	42	0	12	45	2	6	46	0	23	47	3	20	51	1	15	9	1	3

According to these Tables the daily gains per head during the different intervals were—

	Dec. 21 to Feb. 1.	Feb. 1 to Feb. 13.	Feb. 13 to Mar. 13.	Mar. 13 to April 17.
	lbs.	lbs.	lbs.	lbs.
With Silage	$2\frac{1}{10}$	$3\frac{7}{10}$	$1\frac{1}{28}$	2
With Roots and Hay-chaff	$2\frac{1}{3}$	$1\frac{1}{2}$	$1\frac{3}{4}$	$2\frac{3}{4}$

Over the whole period of 113 days.

	lbs.	oz.
Gain per head daily with Silage	2	1
" " Roots and Hay-chaff ..	2	5

Daily gain in favour of Roots and Hay-chaff, 4 oz. per head.

By these results it is shown that bullocks fed on sour grass silage of good quality will fatten well, though not quite so well as when fed on a mixture of roots and hay chaff. Taken in conjunction with last year's experiment, it would appear that upon the quality of the silage the matter of ultimate gain or loss depends; but even under favourable circumstances a better result is got from roots and hay chaff.

SECOND EXPERIMENT.—SWEET SILAGE *v.* ROOTS AND HAY CHAFF.

(a) *Notes on Silo* 1.—The silage used in this experiment was that from Silo 1, filled as follows:—

	tons.	cwts.	qrs.	lbs.
July 4—1 load	0	14	2	20
„ 7—$1\frac{1}{2}$ loads	1	15	2	12
„ 10—1 load	1	2	3	19
Total ..	3	13	0	13

During the time of filling the weather remained fine. The one load put in on July 4th was merely trodden lightly at the sides and not weighted at all that day; the height was 2 ft. 6 in. It was settled, in order to ensure getting really *sweet* silage, to put in but small quantities of grass at a time, allowing the whole to attain a temperature of at least 122° F. before adding more. This is the point which Mr. George Fry, the well-known advocate of "sweet" silage, considers must be reached in order to get the desired result. On July 4th, after filling in the first load, the temperatures varied from 80° F. to 86° F. over different parts; on the 5th inst., 100° F. to 112° F; 6th inst., 106° F. to 110° F.; and on the 7th inst., 130° F. to 135° F., throughout the entire mass. The top of the silage was completely soaked, the water having risen in vapour, and condensed on the cooler surface. At the same time the grass began to change its colour, assuming just below the surface a brownish colour. It thus took three days to reach the desired point; immediately under the surface of the damp top layer the thermometer registered 122° F. On the 7th, a fresh load and a half were added, making the height 5 feet. This caused the temperature to fall rapidly; on the 8th, the readings were 74° F. to 78° F. only. After this the heat increased quickly, and on the 10th, 130° F. was again reached. Just below the surface the temperature was 140° F. to 150° F., and the grass was turning colour quickly. Another load was now put in and the height was 6 ft. 6 in. Again the heat was lowered and afterwards rose; on July 16th, when the silo was weighted, the temperature reached 145° F. to 154° F. in different

parts. As the top began to show mouldiness, Willesden paper was spread over it, then came boards with stones in boxes, the pressure being 112 lbs. per square foot. By the 17th, the contents had sunk 2 feet, but did not sink much after this. Some of the temperatures registered daily are recorded here, being given, as before, on the Fahrenheit scale.

TABLE II.—RECORD of TEMPERATURES in SILO No. 1.

Date.		Temperature of Barn.	Front, 1 ft. deep.	Centre, 4 ft. deep.	Back, 2 ft. deep.
1885.					
July 4	..	65°	86°	80°	80°
„ 5	..	..	112	104	100
„ 6	..	..	106	109	110
„ 7	..	..	135	130	130
„ 8	..	65	78	74	74
„ 9	..	65	78	71	74
„ 10	..	66	110	90	86
„ 11	..	66	132	123	140
„ 13	..	62	140	143	150
„ 14	..	66	150	..	..
„ 15	..	66	155	..	..
„ 16	..	68	154	..	..
„ 20	..	65	120	100	120
„ 21	..	65	112	98	112
„ 22	..	64	110	97	111
„ 23	..	65	106	94	106
„ 24	..	65	102	92	104
„ 25	..	64	102	92	102
„ 26	..	73	101	92	101
„ 27	..	74	100	91	100
„ 28	..	64	98	90	98
„ 29	..	62	95	90	95
„ 30	..	63	92	89	92
„ 31	..	60	90	87	91
Aug. 1	..	61	89	87	90
„ 15	..	65	76	62	74
Sept. 2	..	57	64	64	63
Oct. 2	..	54	60	60	60
Nov. 2	..	46	54	54	54
Dec. 17	..	48	48	49	48
Dec. 28	..	44	63	49	48
1886.					
Jan. 6	..	36	66	52	50
„ 23	..	35	..	46	66

The silo was opened on December 18th, the depth of silage being then only 3 ft. 7 in. Mould was found to penetrate for 5 in. below the surface, and 4 in. inwards from the front wall. The silage was very hot and steaming; a thermometer put in registered 130° F. Near the bottom the material was quite dry, and very like hay in appearance. The silage had a most fragrant smell, quite distinct from the sour silage also opened the

same day. There was no question as to "sweet" silage having been made, and chemical analysis subsequently showed that out of 6 samples analysed, 4 contained no acetic acid whatever, and the other 2 the least trace (·03 per cent.). This silage, however, kept but badly and soon turned mouldy, so that at the rather slow rate at which the bullocks consumed it, much went altogether bad. Besides this it was very variable in quality and in dryness. It was removed in 4 cuts, the several weighings giving:—

	tons.	cwts.	qrs.	lbs.
Total weight of Grass put into Silo 1	3	13	0	13
„ Silage removed	3	3	3	12
Loss by evaporation, fermentation, &c. ..		9	1	1

Or 12·66 per cent.

(b) *Results of Feeding Trial.*—Two bullocks were fed in the closed shed upon sweet silage, in addition to cake and meal as given in the former experiment, while two others were put side by side, but fed on roots and hay-chaff instead of silage. The average daily quantities of food consumed per head were:—

Receiving Silage.		Receiving Roots and Hay.	
	lbs.		lbs.
Decorticated Cotton-cake	3	Decorticated Cotton-cake ..	3
Maize-meal	5	Maize-meal	5
Sweet Silage	43⅔	Swedes	45
Water	53½	Hay-chaff	10
		Water	22½

Here again the silage-fed animals drank a very large quantity of water, and considerably more than with the sour silage. The 4 bullocks were selected and weighed on December 21st, when the experiment started. Weighings were taken on February 1st and February 13th, by which latter date the sweet silage was all finished. The results were:—

Receiving Sweet Silage.	Dec. 21.			Feb. 1.			Feb. 13.			Total gain in live-weight in 54 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 9	10	0	9	10	3	7	10	3	3	0	2	22
No. 10	10	2	25	11	2	14	11	1	20	0	2	23
Total of 2 bullocks ..	20	3	6	22	1	21	22	0	23	1	1	17

Receiving Roots and Hay-chaff.	Dec. 21.			Feb. 1.			Feb. 13.			Total gain in live-weight in 54 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 11	10	3	15	11	1	0	11	2	13	0	2	26
No. 12	10	2	3	11	1	17	11	2	3	1	0	0
Total of 2 bullocks ..	21	1	18	22	2	17	23	0	16	1	2	26

Gain per head daily with sweet silage .. .. .. 1 lb. 7 oz.
„ „ roots and hay-chaff .. .. 1 lb. 12½ oz.

Here, as in the case of the sour silage, there was a gain in favour of roots and hay chaff, so that there would appear to be no greater feeding value in sweet silage than in sour. I do not wish to attach too much importance to this, however, for this experiment was not of such an extended or complete kind as the other, the number of animals being smaller, and the duration of the experiment shorter. Still it gives indications which cannot be overlooked.

Third Experiment.—Oat Silage *v.* Roots and Straw Chaff.

(a) *Notes on Silo* 3.—This silo was filled in July 1884 with chaffed oats, and hence the silage was a year and a half old when opened. It was weighted like the other silos. On opening it on December 18th, 1885, a very considerable amount of waste was found by the boarded doorway, extending for as much as 18 inches inwards; 6 inches from the surface was sodden and bad, and by the sides 2 to 3 inches. When the moulded front portion had been removed, the rest was found to be in excellent condition, having a very aromatic and decidedly pleasant smell. It also kept for a long time without moulding, even when freely exposed. In July 1886 there was a quantity left, still perfectly good, which had been exposed since April. The silage was decidedly acid.

	tons.	cwts.	qrs.	lbs.
Weight of Green Oats put into Silo, July 23, 1884	18	3	0	0
„ Oat Silage weighed out	15	8	1	13
Loss by fermentation, evaporation, &c. ..	2	14	2	15

Or 15·05 per cent.

(b) *Feeding Trials.*—Two bullocks, which consumed on an average per head daily the usual amount of cake and corn, and 52 lbs of oat-silage, were tried in the open yard against 2 others receiving cake and meal, 45 lbs. of swedes, and $9\frac{2}{3}$ lbs. of straw-chaff. The silage-fed animals drank each daily about $28\frac{1}{2}$ lbs. of water, the root-fed ones $13\frac{1}{2}$ lbs. only. It should be mentioned that in previous experiments, bullocks kept out in the yard had done as well as those in the boxes.

The experiment lasted from December 21st to March 13th, the weights being :—

Receiving Oat Silage.	Dec. 21.			Feb. 1.			Feb. 13.			March 13.			Total gain in live-weight in 82 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 13	10	1	25	10	3	21	11	0	24	11	3	12	1	1	15
No. 14	11	0	20	11	2	26	11	3	27	12	2	16	1	1	24
	21	2	17	22	2	19	23	0	23	24	2	0	2	3	11

Receiving Roots and Straw-chaff.	Dec. 21.			Feb. 1.			Feb. 13.			March 13.			Total gain in live-weight in 82 days.		
	cwts.	qrs.	lbs,	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 15	10	2	16	11	0	16	11	1	11	11	3	15	1	0	27
No. 16	10	2	16	10	3	8	10	3	14	11	1	14	0	2	26
	21	1	4	21	3	24	22	0	25	23	1	1	1	3	25

Gain per head per day with Oat Silage .. .. nearly 2 lbs.
" " Roots and Straw-chaff .. .. $1\frac{1}{3}$ "

From February 13th to March 13th a similar experiment was tried; the two bullocks, 9 and 10, which had been in the shed eating sweet grass silage, having now consumed it all, were at liberty, and to these oat silage was given, bullocks 11 and 12 still having roots, but now straw chaff was given in place of hay.

This interim experiment continued from February 13th to March 13th. About 41 lbs. of oat silage having been eaten per head daily, and 32 lbs. of water drunk, as against 8 lbs. of straw chaff, 45 lbs. of roots, and 12 lbs. of water,—the weights were :

Receiving Oat Silage.	Feb. 13.			March 13.			Total gain in live-weight in 28 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 9	10	3	3	11	1	10	0	2	7
No. 10..	11	1	20	12	0	6	0	2	14
	22	0	23	23	1	16	1	0	21
Receiving Roots and Straw-chaff.	**Feb. 13.**			**March 13.**			**Total gain in live-weight in 28 days.**		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 11..	11	2	13	12	0	0	0	1	15
No. 12..	11	2	3	11	3	9	0	1	6
	23	0	16	23	3	9	0	2	21

Gain per head daily on Oat Silage .. .. $2\frac{4}{7}$ lbs.
" " Roots and Straw-chaff .. .. .. $1\frac{3}{7}$ lb.

This interim experiment thus quite confirmed the previous one, and bore testimony to the high feeding properties of the oat silage.

Fourth Experiment.—Oat Silage *v.* Hay.

The grass was cut on July 4, 1885, being the same as that used for sour and sweet silage. Six loads, weighing 7 tons 6 cwts. 1 qr. 12 lbs., were carted into a meadow and spread there. The new hay was stacked on July 6th, when it weighed 2 tons 11 cwts. 21 lbs. The different lots of old hay weighed out amounted to 2 tons 5 cwts. 3 qrs. 17 lbs., the percentage loss on the fresh grass being 68·63, of which 65·53 per cent. was water. Eight bullocks were used for this experiment, which lasted from March 13th to April 24th. Two bullocks belonging to each set were kept in the shed, and two in the yard. Oat silage in the one case, and hay in the other, were given *ad libitum*, with cake and corn as before.

The average quantities consumed per head daily were: oat silage, 49 lbs.; hay, $19\frac{1}{2}$ lbs. Those taking silage drank 40 lbs. of water, those taking hay 68 lbs. each daily.

The results were :—

In Shed.

Receiving Oat Silage.	March 13.			April 24.			Total gain in live-weight in 42 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 9	11	1	10	11	3	12	0	2	2
No. 10	12	0	6	12	2	2	0	1	24
	23	1	16	24	1	14	0	3	26

Receiving Hay.	March 13.			April 24.			Total gain in live-weight in 42 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 11	12	0	0	12	0	5	0	0	5
No. 12	11	3	9	12	1	12	0	2	3
	23	3	9	24	1	17	0	2	8

Gain per head daily on Oat Silage .. .. .. $1\frac{1}{3}$ lbs.
„ „ Hay .. .. $\frac{5}{7}$ lb.

In Yard.

Receiving Oat Silage.	March 13.			April 24.			Total gain in live-weight in 42 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 13	11	3	12	12	1	12	0	2	0
No. 14	12	2	16	13	0	6	0	1	18
	24	2	0	25	1	18	0	3	18

Receiving Hay.	March 13.			April 24.			Total gain in live-weight in 42 days.		
	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
No. 15	11	3	15	12	1	13	0	1	26
No. 16	11	1	14	11	2	19	0	1	5
	23	1	1	24	0	4	0	3	3

Gain per head daily on Oat Silage .. .. .. $1\frac{1}{5}$ lbs.
„ „ Hay .. .. 1 lb.

Taking together the results of the third and fourth experiments, it is clear that oats cut green and made into silage will produce a very valuable feeding material, and one which in the present instance has proved superior to either roots and straw-chaff mixed, or to hay. Further, the interesting fact has been brought forward that such silage will, if well made, keep perfectly good for at least two years, so that its immediate consumption is not imperative. At the same time, as Sir John Lawes has pointed out, it has yet to be shown whether a more profitable result cannot be obtained by allowing the oat crop to ripen thoroughly and reaping it as grain and straw, than by cutting it in the green state for silage.

As considerable attention has been drawn of late to the relation of live and dead weights, I append the following table of actual weights recorded in the case of the first eight bullocks, when the feeding experiment closed and the beasts were slaughtered. The remaining eight are not given, as they were employed in more than one experiment and had various foods at different times:—

Bullock.	Food.	Live-weight, taken at Woburn.					Calculated into Stones of 14 lbs.		Official Dead-weight, 8 lbs. per stone.		
		Date.	cwts.	qrs.	lbs.		stns.	lbs.	stns.	lbs.	Date.
1	Sour Silage ..	April 19	12	0	7	=	96	7	92	7	April 21
2	,,	,, 17	12	1	7	=	98	7	97	5	,, 20
3	,,	,, 19	13	3	9	=	110	9	110	6	,, 21
4	,,	,, 19	12	1	26	=	99	12	95	4	,, 21
5	Roots and Hay	,, 27	12	2	8	=	100	8	106	1	,, 29
6	,,	,, 27	11	1	4	=	90	4	96	0	,, 28
7	,,	,, 27	13	3	13	=	110	13	110	0	,, 29
8	,,	,, 27	13	0	7	=	104	7	105	1	,, 29

The dead weights were taken in the market by an official appointed for the purpose, and represent the weights of saleable meat after the removal of the offal. A comparison of the two sets shows that the bullocks fed on roots and hay have come out considerably better in the matter of dead weight than the silage-fed ones, which is a point of considerable importance.

Chemical Composition of the contents of Silos 1, 3, *and* 4.

From a large number of analyses taken as the several cuts of silage were removed, the average composition of the contents of each silo was obtained:—

	Silo 1. "Sweet Silage" (grass).	Silo 3. Oat Silage.	Silo 4. Sour Silage (grass.)	Hay.
Moisture	64·63	76·28	72·62	13·62
Soluble albuminoids	·65	·28	·69	2·44
Insoluble albuminoids	2·21	·67	1·10	6·12
Digestible fibre	10·97	7·51	7·92	27·75
Woody fibre	9·81	8·56	8·00	25·43
Volatile acids (reckoned as acetic acid)	·01	·29	·32	..
Fixed acids (reckoned as lactic acid)	·13	·20	·48	..
Soluble carbo-hydrates, chlorophyll, &c.	8·70	4·36	6·53	17·36
Mineral matter	2·89	1·85	2·34	7·28
	100·00	100·00	100·00	100·00
Total nitrogen	·67	·30	·51	1·74
Albuminoid nitrogen	·45	·15	·28	1·37
Non-albuminoid nitrogen ..	·22	·15	·23	·37

The composition of the fresh grass varied considerably according to the day and time when it was cut, and rendered it necessary to compute separately the composition of the total weight of grass filled into each silo.

My investigations on the important point of the losses undergone during the different processes of ensilage have not been sufficiently complete to justify me in putting them forward at the present time. The practical difficulties in arriving at a true estimate of the composition of the contents of a silo, and instituting a comparison with the grass as used in its fresh state, are very great; indeed it is only those who have had to deal with an experiment of this kind who can possibly be aware of the sources of error that may arise, and how easily fallacious and misleading results may be put forward.

XVIII.—*Sheep-feeding Experiments conducted at Crawley Mill Farm, Woburn, in the Winter of* 1885–6. By Dr. J. Augustus Voelcker, B.A., B.Sc., Consulting Chemist to the Society.

In 1885, on a portion of Lansome Field, not generally devoted to experiment, a crop of Swedish turnips was grown, which in the ordinary course would have been eaten off by sheep with the addition of some artificial food, to be followed afterwards by a crop of barley. It struck me as desirable, while following this course, at the same time also to carry out a feeding experiment. This suggestion meeting with the approval of the Chemical Committee, a plan of experiment was drawn up. The recent heavy fall in the price of wheat and other cereals grown on the farm has naturally drawn attention to the question as to how far these can be profitably used for home consumption. It was further considered desirable to try by actual experiment whether wheat given to sheep as food would prove, as is frequently supposed to be the case, dangerous. Side by side with these experiments, it was determined to feed sheep according to the usual practice of the county, with linseed-cake and cotton-cake. In addition to the practical matter of feeding, I was interested in a scientific question, to which considerable attention has been directed, viz., that of how far it is necessary that a diet should be nitrogenous in character for profitable results in feeding.

The winter 1885–6 was a very trying one; damp, cold winds, and wet weather, with rapid alterations of atmospheric conditions, acting very prejudicially upon the health of the sheep, and indeed causing the loss of several; altogether the conditions were most unfavourable for the well-being of the animals. The crop of Swedish turnips grown in 1885 was a very fair one for the county and the year. When ripe they were pulled up, topped, tailed, put in heaps, and covered with straw and earth. The sheep were folded on the land, and supplied with sliced turnips, the experiment being carried on as long as the roots remained sound and good. The sheep experimented on were a cross of the Hampshire and Oxfordshire Down breeds, about ten months old. On December 3rd, forty sheep were selected, and divided into five pens of eight sheep each, the weights being as given in Table I.

Previous to the commencement of the experiment the sheep had been a short time upon the roots, in order to get them accustomed to the food.

TABLE I.—WEIGHTS of SHEEP put under EXPERIMENT on DECEMBER 3, 1885.

Pen I.			Pen II.			Pen III.			Pen IV.			Pen V.		
cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.	cwts.	qrs.	lbs.
	3	14¼		3	23½	1	0	20½	1	0	6½		3	12¼
	3	25¼	1	0	7	1	0	14	1	0	15¼	1	0	7¾
1	0	4¾		3	27	1	0	8½	1	0	1¼	1	0	3¼
	3	20	1	0	1¼	1	0	9¼		3	14¼		3	27¼
1	0	6	1	0	8¾		3	27		3	8½	1	0	0½
1	0	16¼		3	23		3	21	1	0	13	1	0	7¾
1	0	12¼	1	0	6		3	16½	1	0	7	1	0	26¼
1	0	5¾	1	0	6¾		3	15¾	1	0	10½		3	20¼
8	0	20½	8	0	19¼	8	0	20½	8	0	20¼	8	0	21¼

The sheep were supplied with sliced swedes and hay-chaff *ad libitum*, the weights of each given being, however, recorded; and they received as additional food:—

PEN I.—Linseed-cake.
PEN II.—Linseed-cake and Undecorticated Cotton-cake.
PEN III.—Wheat-meal.
PEN IV.—Crushed Oats and Barley-meal.
PEN V.—Crushed Oats and Split Beans.

The different foods were analysed in the Society's Laboratory, and the composition of each was as follows:—

	Linseed Cake.	Undecorticated Cotton Cake.	Wheat Meal.	Crushed Oats.	Barley Meal.	Split Beans.
Moisture	11·50	14·90	13·98	14·22	19·01	13·85
Oil	12·01	5·13	·53	6·47	2·17	1·90
*Albuminous compounds	25·81	20·87	14·35	8·81	10·66	28·94
Starch, mucilage, digestible fibre, &c.	32·03	30·18	66·97	65·71	63·09	47·45
Woody fibre	11·80	24·27	1·93	1·20	3·27	4·67
Mineral matter ..	6·85	4·65	2·24	3·59	1·80	3·19
	100·00	100·00	100·00	100·00	100·00	100·00
*Containing nitrogen	4·13	3·34	2·29	1·41	1·70	4·63

The foods were all of good quality. The linseed-cake was a pure and superior one.

Analyses of Swedes and Hay-chaff.

	Swedes.	Hay-chaff.
Water	89·60	13·62
*Albuminous compounds	1·10	8·61
Sugar, digestible fibre, &c.	7·58	45·49
Woody fibre	1·00	25·43
Mineral matter	·72	6·85
	100·00	100·00
* Containing nitrogen	·17	1·37

The following Table gives the market-prices of the different cakes and meals employed, at the time the experiment commenced:—

	s.	d.		£	s.	d.	
Linseed-cake, per 112 lbs.	9	0	or	9	0	0	per ton.
Undec. Cotton-cake, per 112 lbs. ..	5	7	or	5	12	6	per ton.
Wheat-meal, per 124 lbs. = 2 bush. whole wheat	*7	4½	or	1	8	6	per quarter.
Crushed Oats, per 84 lbs. = 2 bush. whole oats	*5	4½	or	1	0	6	per quarter.
Barley Meal, per 112 lbs. = 2 bush. whole barley	*7	1½	or	1	8	6	per quarter.
Split Beans, per 144 lbs. = 4 bushels	13	0	or	1	6	0	per quarter.

* These prices include grinding.

At starting, the quantity of additional food given in the case of each pen was ½ lb. per head daily. Thus Pen I. had ½ lb. of linseed-cake per head daily, Pen II., ¼ lb. of linseed-cake, and ¼ lb. of undecorticated cotton-cake, and so on. It was intended to continue the experiment for three months, giving for the first month ½ lb. per head daily of additional food, ¾ lb. the second month, and possibly 1 lb. the third month. The linseed-cake and cotton-cake were given broken up into small lumps, and the wheat and barley were ground into meal; the oats were crushed, and the beans split.

From the beginning the sheep began eating their full daily allowance of ½ lb. each of cake and corn, in addition taking at first ¼ lb. each daily of hay-chaff, and 11 to 12 lbs. of swedes. The latter quantities were gradually increased up to ½ lb. of hay-chaff, and 20 lbs. of swedes. In Pen III. alone (wheat-meal) there seemed a reluctance to take the full quantity, and sometimes a rather less quantity of swedes also was consumed. Whatever was not cleaned up was weighed back. Thus the

experiment continued until the first period of 33 days was over, when the sheep were weighed as follows:—

TABLE II.—WEIGHTS of the FIVE PENS of SHEEP after the FIRST PERIOD of 33 DAYS, DECEMBER 3, 1885, to JANUARY 6, 1886.

	Pen I. Linseed Cake.	Pen II. Linseed Cake and Cotton Cake.	Pen III. Wheat Meal.	Pen IV. Crushed Oats and Barley Meal.	Pen V. Crushed Oats and Split Beans.
	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.
Weights of Sheep ..	1 0 2	1 0 1	1 1 9	1 1 4	1 0 0
	1 0 13	1 0 14	1 1 0	1 1 5	1 0 23
	1 0 20	1 0 19	1 0 21	1 0 10	1 1 0
	3 26	1 0 12	1 0 19	1 0 2	1 0 16
	1 0 7	1 0 20	1 0 17	3 17	1 0 14
	1 1 19	1 0 8	1 0 12	1 0 23	1 0 14
	1 1 2	1 0 19	3 22	1 0 17	1 1 12
	1 0 19	1 0 19	1 0 4	1 1 11	1 0 8
Total weight of 8 Sheep on Jan. 5, 1886	9 0 24	9 0 0	9 0 20	9 1 5	9 1 3
Total weight of 8 Sheep on Dec. 3, 1885	8 0 20½	8 0 19¼	8 0 20½	8 0 20¼	8 0 21¼
Gain in live weight in 33 days	1 0 3½	3 8¾	3 27½	1 0 12¾	1 0 9¾
= lbs.	115½	92¾	111½	124¾	121¾
Daily increase per head	7 oz.	5·6 oz.	6·7 oz.	7·6 oz.	7·4 oz.

It will be noticed that, though Pen III. (wheat-meal) did not take very kindly to their food, the increase in their live-weight was very satisfactory, being but little behind that due to linseed-cake. Oats and barley-meal gave the highest return, and the lowest was got with linseed-cake and undecorticated cotton-cake.

The food consumed for all the above pens was, on an average, per head daily:—Swedes, 20 lbs.; hay, ½ lb.; additional artificial food, ½ lb.

The second period was commenced on January 6th, 1886, the quantity of additional food being increased to ¾ lb., except in the case of Pen III., in which the sheep did not clean up their daily allowance of ½ lb. each of wheat-meal.

At the suggestion of Mr. Charles Howard, who visited the farm about this time, whole wheat was tried instead of wheat-meal, Mr. Howard having noticed that the wheat-meal seemed to hang very much about the jaws of the sheep. The change was accordingly made, and the effect was very remarkable; for

the sheep which, up to now, would barely clean up the ½ lb. allowance of wheat-meal, now readily ate ¾ lb. of the whole wheat. Concurrent with the increase of additional food, the sheep in all the pens now only ate ¼ lb. of hay-chaff each daily, together with the 20 lbs. of swedes as before.

About this time most severe weather set in, and the sheep suffered very much. The sheep on other parts of the farm, not under experiment, had already experienced the effects of the cold winds and wet weather coming together, with alternations of frost and damp, and several had died. The experimental sheep now began to suffer too, and on January 18th, one out of Pen III. (wheat) had to be removed, and subsequently killed, inflammation of the lungs (as was shown by subsequent examination) having attacked it. On February 4th, one died out of Pen V., while on February 7th, yet another died out of Pen IV., giddiness and clot on the brain being the outcome of the severe atmospheric changes. The remainder were re-weighed on February 8th, at the end of the second period of thirty-four days, as follows:—

TABLE III.—WEIGHTS of the FIVE PENS of SHEEP after the SECOND PERIOD of 34 DAYS, JANUARY 5, 1886, to FEBRUARY 8.

	Pen I. Linseed Cake.	Pen II. Linseed Cake and Cotton Cake.	Pen III. Wheat.	Pen IV. Crushed Oats and Barley Meal.	Pen V. Crushed Oats and Split Beans.
	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.
Weights of Sheep ..	1 0 10	1 0 7	1 1 13	1 1 15	1 0 0
	1 0 23	1 0 22	1 1 10	1 1 6	1 1 0
	1 0 26	1 0 18	1 0 24	1 0 16	1 1 2
	1 0 10	1 0 21	1 0 25	1 0 9	1 0 20
	1 1 0	1 1 3	..	3 21	1 0 18
	1 1 18	1 0 21	1 0 18	..	1 0 17
	1 1 21	1 1 3	3 20	1 0 17	..
	1 1 5	1 0 26	1 0 4	1 1 7	1 0 13
Total weight of sheep on Feb. 8	10 0 1	9 2 9	8 1 2	8 1 7	8 0 14
Total weight of sheep on Jan. 5	9 0 24	9 0 0	8 0 3	8 0 10	7 3 19
Gain in live-weight in 34 days	3 5	2 9	27*	25*	23*
= lbs.	89	65	27*	25*	23*
Daily increase per head	5·2 oz.	3·8 oz.	1·8 oz.	1·7 oz.	1·5 oz.

* Seven sheep only—one having died.

In explanation of the varying length of the periods, it will be borne in mind that, owing to the state of the atmosphere, it is

frequently impossible to weigh sheep at the conclusion of a set number of days, as the error due to increased weight of the fleeces through excess of moisture may be greater than any real difference in live-weight. It will be seen by Table III. that during this very trying period the sheep fed on cake had a most decided advantage. Not only was there a steady gain in live-weight as compared with the sheep fed on other foods, but, in spite of the cold and wet, no death occurred in either of these two pens. How far this was a result of circumstances unconnected with the foods I am unable to say; though at the same time it must be said that veterinary examination of the cases where death occurred showed it not to be due to any injurious effect produced by the wheat.

On commencing the third period of feeding, as the sheep did not do more than clean up their food, and as they were still young, it was decided not to further increase the allowances of food, but to keep them on the same amounts as during the previous period. Accordingly the foods remained as before, viz., 20 lbs. of swedes per head daily, $\frac{1}{4}$ lb. of hay-chaff, and $\frac{3}{4}$ lb. of cake and corn. Owing to the deaths in several of the pens, the total quantities of food consumed in each period are omitted, and only calculated for those of the sheep which went through the whole experiment. The third period was again a severe one, the sheep suffering very much. Two more died during this period, viz., on February 28th, a second one out of Pen III. (wheat), and on March 15th, a second one out of Pen V. (oats and beans). The others continued to feed well, but would not have eaten more than the quantities given to them. On March 19th, the third period of thirty-nine days was completed, and the weights taken. The swedes commencing now to show signs of unsoundness, the experiment was brought to a conclusion, having lasted 106 days. The weights for the last period are given in Table IV. (p. 520).

The very great increase due to wheat during this period is remarkable, also that with linseed-cake.

On the following Table (V., p. 520) is given the gain in each pen during the whole period of the experiment.

The gain in individual sheep was much the same, there being no case of actual loss of weight. The lowest gain was above 1 quarter for the whole period, and the highest only just over 2 quarters.

From Table V. it will be seen that the greatest increase in live-weight was obtained in Pen III., by the use of wheat, Pen I. (linseed-cake) being very nearly similar, while the differences between Pen II. (linseed and cotton-cake), Pen IV. (oats and barley), and Pen V. (oats and beans), were small.

TABLE IV.—WEIGHTS of the FIVE PENS of SHEEP after the THIRD PERIOD of 39 DAYS, FEBRUARY 8, 1886, to MARCH 19, 1886.

	Pen I. Linseed Cake.	Pen II. Linseed Cake and Cotton Cake.	Pen III. Wheat.	Pen IV. Crushed Oats and Barley Meal.	Pen V. Crushed Oats and Split Beans.
	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.
Weights of Sheep ..	1 1 14	1 1 1	1 2 14	1 2 16	1 0 22
	1 1 21	1 1 19	1 2 10	1 2 0	1 1 23
	1 1 23	1 1 2	..	1 1 5	1 2 0
	1 1 8	1 1 21	1 2 2	1 1 9	1 1 14
	1 2 4	1 2 8	..	1 0 4	1 1 3
	1 2 23	1 1 21	1 1 24	..	..
	1 2 14	1 2 6	1 1 18	1 1 12	..
	1 1 13	1 1 14	1 1 6	1 1 21	1 1 3
Total weight of sheep on March 19 ..	11 3 8	11 0 17	8 3 18	9 2 11	8 0 9
Total weight of sheep on Feb. 8	10 0 1	9 2 9	7 0 6	8 1 7	6 3 25
Gain in live-weight in 39 days	1 3 7	1 1 8	1 3 12*	1 1 4†	1 0 12*
= lbs.	203	148	208*	144†	124*
Daily increase per head	10·4 oz.	7·6 oz.	14·7 oz.	8·5 oz.	8·5 oz.

* Six sheep only. † Seven sheep only.

TABLE V.—INCREASE in WEIGHT during the WHOLE PERIOD of 106 DAYS, from DECEMBER 3, 1885, to MARCH 19, 1886.

	Pen I. Linseed Cake.	Pen II. Linseed Cake and Cotton Cake.	Pen III. Wheat.	Pen IV. Crushed Oats and Barley Meal.	Pen V. Crushed Oats and Split Beans.
	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.	cwts. qrs. lbs.
Total weight of sheep on March 19, 1886 ..	11 3 8	11 0 17	8 3 18	9 2 11	8 0 9
Total weight of sheep on Dec. 3, 1885 ..	8 0 20⅓	8 0 19¼	6 0 13	7 0 7¼	5 3 15
Total increase in weight of sheep in 106 days	3 2 15½	2 3 25¾	2 3 5*	2 2 3¾†	2 0 21
= lbs.	407½	333¾	313*	283¾†	245¾*
Increase per head during whole period	51 lbs.	41 lbs. 11½ oz.	52 lbs. 2⅔ oz.	40 lbs. 8½ oz.	40 lbs. 15⅓
Daily increase per head	7·7 oz.	6·3 oz.	7·9 oz.	6·1 oz.	6·2 oz.

* Six sheep only. † Seven sheep only.

Considered as an addition to linseed-cake, the use of undecorticated cotton-cake would not appear to be one of extra profit, whilst a nearly identical feeding result obtained by barley in addition to oats would not appear to warrant the increased expenditure involved in using beans instead. Regarding the foods in view of their chemical composition, and of the most desirable combination to produce a good feeding result, it will be sufficient to consider the two lots which did best, viz., Pen I. (linseed-cake), and Pen III. (wheat), the daily allowance to each sheep having been:—

Pen I.	Pen III.
20 lbs. Swedes.	20 lbs. Swedes.
¼ lb. Hay-chaff.	¼ lb. Hay-chaff.
¾ lb. Linseed-cake.	¾ lb. Whole Wheat.

The following analyses show the composition of the diets:—

	20 lbs. Roots contained.	¼ lb. Hay contained.	¾ lb. Linseed-cake contained.	Total.	Percentage Composition of Mixed Food.
	lbs.	lbs.	lbs.	lbs.	lbs.
Moisture	17·92	·034	·086	18·04	85·90
Oil	..	..	·090	·09	·43
*Albuminous compounds	·22	·027	·193	·44	2·09
Sugar, mucilage, digestible fibre, &c.	1·52	·108	·240	1·87	8·90
Woody fibre	·20	·064	·088	·35	1·67
Mineral matter	·14	·018	·052	·21	1·01
Total	20·00	·251	·749	21·00	100·00
*Containing nitrogen	·034	·003	·031	·068	·33

	20 lbs. Roots contained.	¼ lb. Hay contained.	¾ lb. Wheat contained.	Total.	Percentage Composition of Mixed Food.
	lbs.	lbs.	lbs.	lbs.	lbs.
Moisture	17·92	·034	·105	18·06	86·00
Oil	..	..	·004	·004	·02
*Albuminous compounds	·22	·027	·107	·36	1·72
Starch, sugar, mucilage, digestible fibre, &c.	1·52	·107	·505	2·132	10·16
Woody fibre	·20	·063	·014	·27	1·29
Mineral matter	·14	·018	·016	·17	·81
Total	20·00	·249	·751	21·00	100·00
*Containing nitrogen ..	·034	·003	·017	·054	·26

According to these figures the albuminoid ratios of the two sets of food were :—

PEN I.—(Linseed-cake)	1	:	5·55
PEN III.—(Wheat)	1	:	6·68

It will be obvious that in considering the relative advantages of different artificial foods, it is not sufficient to take merely the increase in live-weight obtained by the use of any one, or a combination of several, but the relative *cost* must also be an item for consideration. I have endeavoured to meet this in the present case. The cost of the additional food, taking the then market prices as already given, was as follows :—

PEN I. (8 Sheep).

Linseed-cake :—		
33 days at ½ lb. each	132 lbs.	
76 days at ¾ lb. each	456 lbs.	
	588 lbs.	Cost, £2 7*s.* 3*d.*

PEN II. (8 Sheep).

		£	*s.*	*d.*
294 lbs. Linseed-cake	cost	1	3	7½
294 lbs. Undecorticated Cotton-cake	„		14	8
		£1	18	3½

PEN III.

		£	*s.*	*d.*
558 lbs. Wheat	cost	1	14	11

PEN IV.

			s.	*d.*
294 lbs. Crushed Oats	cost		18	9¾
294 lbs. Barley-meal	„		18	8½
		£1	17	6¼

PEN V.

		£	*s.*	*d.*
294 lbs. Crushed Oats	cost		18	9¾
294 lbs. Split Beans	„	1	6	6½
		£2	5	4¼

Hence the cost per lb. of increase was :—

PEN I.—Linseed-cake	1·39*d.*
PEN II.—Linseed-cake and Undec. Cotton-cake	1·38*d.*
PEN III.—Wheat	1·00*d.*
PEN IV.—Oats and Barley	1·39*d.*
PEN V.—Oats and Split Beans	1·66*d.*

From this last calculation it appears that wheat, regarded only as a feeding material, is the cheapest ; linseed-cake, linseed-cake and cotton-cake mixed, and oats and barley mixed, being equal ; whilst the mixture of oats and beans is the dearest. Also that

the addition of undecorticated cotton-cake to linseed-cake has not given a more profitable feeding result.

Having considered the foods in respect of their cost and relative feeding values, the further feature of their relative effects as manurial agents must not be overlooked. Doubtless the most satisfactory way of settling this would have been by the actual experiment of growing subsequent crops of barley, &c., by the manure from each pen. Previous experiments, however, having told how varying the soil of this field was, and that it could not be relied upon to give correct results, this plan was found to be impracticable. In the Tables of the manurial values of purchased foods, drawn up by Sir J. B. Lawes and Dr. Gilbert, we have, however, data which may be applied here. Taking the figures therein given, the following are the manurial values per ton of food consumed:—

	Manurial Value per Ton. £	s.	d.
Linseed-cake	3	18	6
Undecorticated Cotton-cake	3	8	8
Beans	3	3	5
Oats	1	9	10
Wheat	1	8	7
Barley	1	6	1

From these figures it is apparent that the manurial value of the mixture of linseed-cake and undecorticated cotton-cake is less than of linseed-cake alone, whilst, as regards the mixtures of oats and barley and of oats and beans, these are lower than either of the cake diets in manurial value, and also, in the case of the one, only equal, and in that of the other lower in feeding value. It will be only necessary, therefore, to compare the linseed-cake and wheat.

Taking the figures of Lawes and Gilbert's Table, the manurial value of the 588 lbs. of linseed-cake used during the 106 days would be 20*s.* 7*d.*; of the 588 lbs. of wheat 7*s.* 6*d.*, or an excess of 13*s.* 1*d.* in favour of the linseed-cake. As against this, we have to consider that in the case of the wheat 418 lbs. of increase were obtained at the rate of 1*d.* for each lb., whilst the cost of 1 lb. of increase with linseed-cake was 1·39*d.* Hence the extra cost due to linseed-cake in producing 418 lbs. increase. would be $418 \times 0{\cdot}39 = 13s.\ 7d.$ This gives over the whole period of 106 days a merely nominal advantage of 6*d.* in favour of wheat as against linseed-cake. Next in order comes the mixture of linseed-cake and cotton-cake, which has a higher manurial value than the remaining two, and an equal or better feeding value. Comparing oats and beans, when mixed in equal proportions, with barley, it will be found that in using 588 lbs.

of mixed oats and barley there is a total of 2*s.* 3*d.* in its favour over the same weight of mixed oats and beans.

Placing the foods in order as they have come out in this experiment, they are:—

Considered as Food only.	*Considered as Food and Manure.*
1. Wheat.	Equal. { Wheat. Linseed-cake.
Equal. { Linseed-cake. Linseed-cake and Cotton-cake, mixed. Oats and Barley, mixed.	3. Linseed-cake and Cotton-cake, mixed. 4. Oats and Barley, mixed.
5. Oats and Beans, mixed.	5. Oats and Beans, mixed.

The practical result of this experiment is to show that wheat may be profitably used for feeding sheep in conjunction with roots and hay-chaff, and that such a diet is sufficiently nitrogenous without the addition of cake. It further confirms the practice of using linseed-cake, either alone or mixed with undecorticated cotton-cake, though it shows that no advantage is gained by the admixture of the latter. It is a singular feature that throughout the severe weather none of the cake-fed sheep died, though whether this should be taken as weighing in favour of cake as against wheat I can hardly say. In no case, however, have the deaths been found to be attributable to the fact of wheat being the food, and the circumstance of one sheep dying in Pen V. (which received a more highly nitrogenous food), would seem to tell against such a supposition. Lastly, it must be borne in mind that fluctuations in market prices must, to some extent, affect these conclusions, which are based upon the respective prices at the time of the experiment.

XIX.—*Report on the Exhibition of Implements at Norwich.* By Sir J. H. Thorold, Bart., Senior Steward.

The Showyard at Norwich was narrow, and somewhat cut up by plantations and trees, which added greatly to its picturesque appearance, but considerably increased the difficulty which the Society's Surveyor had to contend with in laying out the shedding for implements, although they occupied 1000 feet less space than last year. Moreover, the Society has endeavoured to meet the wishes of exhibitors of machinery by allowing implements to be placed in the Machinery in Motion department, whereby makers are enabled to have all their exhibits on one stand, and to avoid the expense of taking additional ordinary shedding; the effect of this has been to increase the popularity of the Machinery

in Motion department, and to add still further to the difficulties of the Surveyor; but the Stewards think that the alteration is an improvement which does not interfere with the interests of the Society.

The Implement Yard and Working Dairy were visited by His Royal Highness the President of the Society, who was pleased to express his appreciation of the machinery brought under his notice, and to make a practical trial of the butter and soft cheese produced in the Dairy.

I regret to have to report that the prizes offered for harness in this, the second year in succession, have failed to produce a single set of harness which the Judges could pronounce to be worthy of the prizes offered by the Society. Although the material and workmanship of some of the harness was good, the weight was excessive, and the design antiquated. We are all prepared to admit that there is nothing like leather; but in the interests of the horses we may fairly ask the makers to give us a little less of it, and to try if, by a judicious use of steel, of india-rubber, and of other modern materials, they can reduce the weight while retaining the strength and large bearing surface so necessary for farm-harness.

While there was but one competitor in the class of Thatch-making Machines, I am glad to be able to report that the machine (No. 1917) of Messrs. Barnard and Lake, to which the prize of 25*l.* was awarded, appears in every way to meet the requirements of the Society; it is moderate in price, and simple and easy in action, while the thatch produced can be used for a variety of purposes, both in the garden and on the farm.

The prize of 15*l.* offered for a substitute for straw-thatch other than metal produced one exhibit, which the Judges did not consider to be of sufficient merit to entitle the maker to the prize.

Silver medals were awarded to Messrs. Ransome, Sims, and Jefferies; Rainforth and Sons; Smith and Grace; the Aylesbury Dairy Company; and the Dairy Supply Company, whose exhibits will be fully described by the Judges of Implements; but as the Délaiteuse, or Centrifugal Butter Worker, came more immediately under my notice as Steward of the Working Dairy, I may be allowed to say that, when the butter to be worked was cool and sufficiently set to retain its granular form, the water or butter-milk was thoroughly extracted without in any way injuring the grain of the butter. It is much to be desired that some English makers should undertake its manufacture, so as to produce an equally efficient machine at such a price as to bring it within reach of the smaller dairies of this country.

I have to record a new department at the Norwich Show

which I believe to be capable of further extension in the future, namely, the making of French soft cheeses for immediate or early consumption. The Secretary is to be congratulated on having obtained the services of M. Baquet and of his nephew, M. Paul Mispolet, whose success in making a really palatable cheese under such trying conditions of shaken milk, changeable temperature, and penetrating dust, is worthy of all praise. The system adopted in the Working Dairy for producing the soft cheeses called Neufchatel, or Swiss double crême, was thus described in a fly-sheet issued to the public.

Half a gallon of cream mixed with an equal quantity of milk at the temperature of the air is set with only one drop of Hansen's rennet, diluted with ten drops of water, or in the proportion of one drop of rennet to 10,000 drops of the milk and cream. The object of the maker is to obtain a rich and smooth curd; he must not, therefore, use more rennet than is absolutely necessary to convert the milk and cream very slowly into curd.

The quantity of the rennet required will vary with its strength, with the season, with the temperature, and with the age and condition of the milk. Warm, poor, or stale milk will require less rennet; cold milk, or milk enriched with cream, requires more. The exact quantity required under varying circumstances can only be ascertained by experience.

The curd is formed in twenty-four hours; it is then put in a cloth in a light wooden square frame to drain for twelve hours, and gently stirred two or three times, when the cloth is changed, and the curd pressed for about twelve hours. When the whey has been pressed out, the curd is worked smooth in the cloth with a flat trowel, and put into moulds lined with paper, when it can be turned out at once, and disposed of as soon as the cheese is sufficiently firm to bear packing.

It will be observed that the principles of manufacture of these and other soft cheeses is directly opposed to that which regulates the making of English hard cheeses, such as Cheddar, Cheshire, Derbyshire, Gloucestershire, &c., as follows:—

(1) The quantity of rennet applied is very small indeed.
(2) The temperature is not raised.
(3) The curd is therefore a long time in coagulating.
(4) The curd is neither cooked nor cut.
(5) The curd is carefully and gently lifted from one draining cloth to another.

The moulds measure $2\frac{1}{4}$ inches deep by $1\frac{3}{4}$ inches in diameter, and a gallon of milk and cream will make about 20 cheeses. Mons. Baquet informed me that similar cheeses sold by the Maison Gervais in Paris, secured a ready market on account of their quality, while the makers of inferior cheeses of the same description had great difficulty in disposing of their produce. At the present time considerable quantities of fresh and of ripened soft cheeses are imported into England, and now that butter and milk have both fallen in price, farmers might with advantage undertake the manufacture of these cheeses, which, with the necessary care and attention, can be produced in England as well, or perhaps better, than elsewhere. This year

three sides of the Dairy were left open to the public, whilst the the remainder was devoted to the reserved seats and the necessary offices. The crowds who thronged the Dairy during the week testified to the ability with which Miss Smithard conducted the lectures and demonstrations on butter and on soft cheesemaking. Neither Mons. Baquet nor his nephew spoke English, but Miss Jenkins was a most efficient interpreter, and enabled Miss Smithard to instruct the public in the mystery of soft cheesemaking.

The Society is greatly indebted to the Aylesbury Dairy Company, the Dairy Supply Company, Messrs. Hathaway, Messrs. Bradford, and Messrs. Avery, for the loan of the implements used and exhibited in the Dairy during the week. I regret that, in consequence of a defect in the brickwork foundation of the Aylesbury Dairy Company's Danish Separator, which had to be reconstructed during Friday night, that it was not possible to show it in work until Monday morning, when it ran steadily, and worked most efficiently during the week.

Messrs. Hathorn, Davey, & Co. were to have supplied the motive power for the Dairy; but in their desire to exhibit a novel form of their excellent Domestic Motor, they sent an engine which, although it had run satisfactorily in their own shop, developed some defect either in transit or in the Showyard, which the engineer was unable to correct in the short time allotted to him. The Stewards therefore applied to Messrs. Marshall, of Gainsborough, who kindly placed a six-horse engine at their disposal, which worked the machinery and heated the water to their entire satisfaction.

At this, the termination of my three very pleasant years of office, I wish to thank my brother Stewards and the officials of the Society for assistance ably and willingly rendered, and to thank Mr. Courtney, our Assistant-Engineer, for the great energy and ability with which at all times and in all places he has assisted the Stewards of Implements in the performance of their duties.

XX.—*Report of the Judges of Implements at Norwich.* By John Wheatley, of Watford, Herts.

Judges.

James Edwards, Woodhorn Manor, Morpeth.
T. H. Thursfield, Barrow, Broseley, Shropshire.
John Wheatley, Clarendon Road, Watford.

The Meetings of the Royal Agricultural Society have never been more favoured in the selection of ground and in railway

conveniences for the easy transit of exhibits, than was the forty seventh Anniversary recently held at Crown Point, near Trowse, Norwich; and the Society's best thanks have been awarded to J. J. Colman, Esq., M.P., for his kindness in providing the site, as well as in many ways contributing to the success of the Meeting. A finer display of Implements (though a few less in number than at Preston) representing the latest and most improved results of ingenuity and mechanical skill applied to English agriculture, has never been exhibited. Well may it be said that this exhibition is indeed bewildering in its extent and variety, suggestive alike of the science which modern agriculturists combine with their practice, and of the ability and enterprise of the manufacturers. The opportunity given us at the Colonial and Indian Exhibition of seeing the implements used in India, impels us to a comparison of their primitive simplicity with the increasing advance made here in the production of implements necessary to the efficient tilling of the soil. There, the simple wooden-plough with its point shod with iron, the cost of construction of which by the village blacksmith and carpenter does not exceed one shilling and sixpence; while here, the farmer reckons by hundreds of pounds the value of machinery and implements *essential* to the pursuit of his occupation.

Again the same clause is in the regulations to the Exhibitors entering "New Implements," which (as last year) greatly assisted the Judges in their work, inasmuch as they were not called upon to consider claims of novelty where no novelty existed, though ten entries were found in the Catalogue that ought not to have been designated "New Implements."

In this Report I shall confine myself to noticing specially the various articles to which prizes were awarded, and medals given, and the novelties entered as New Implements; the numerous other exhibits have been before the public and made mention of in former Journals.

The following prizes were offered:—

HARNESS AND GEARS.

CLASS 1.—Set of Harness and Gears for a pair of horses ploughing abreast	£10 and £5
CLASS 2.—Set of Harness for carting, three horses in length	£10 and £5

THATCH.

CLASS 3.—Apparatus for making Thatch for the covering of Stacks	£25
CLASS 4.—Substitute for Straw thatch other than metal ..	£15

We were disappointed in the Harness and Gears exhibited; although four competed, the Judges did not consider that there

was sufficient merit in any of them to entitle any Exhibitor to the prizes offered, but they wish to mention Messrs. Dales and Sons, Wyle Cop, Shrewsbury, Nos. 1924, 1925, for good quality of material and superior workmanship of their exhibits.

Messrs. Barnard and Lake, No. 1917, Thatch-making Machine.—In response to the offer of a special prize by the Society for the best "Apparatus for making Thatch for the Covering of Stacks," this firm exhibited two thatch-making machines. One of these machines was of their old type, in which the needles for securing the thatch worked vertically downwards through the straw; the sewn thatch as it comes from that machine, when rolled up in bundles, leaves the wrong side of the thatch uppermost; it is therefore necessary to re-roll the bundles in the reverse way before they become ready for use.

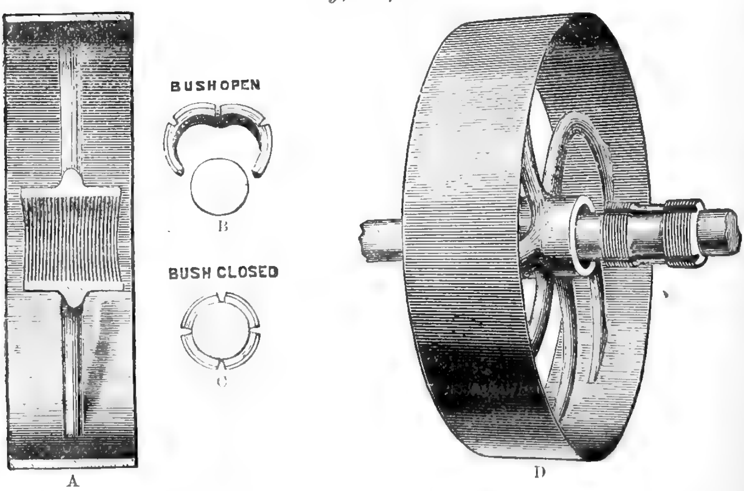
This difficulty is got over in the new machine by the position of the needles being reversed, and working upwards through the straw; so that the sewn thatch when rolled up is ready at once to be laid on the stack. The machine, which costs only 15 guineas, is driven by hand-power, and consists first of an inclined feeding-table on which the straw is laid; it is fed upwards with an intermittent motion by means of two endless chains driven by sprocket-wheels underneath the table, motion being communicated to these wheels by means of an eccentric on the hand-wheel spindle, which actuates a ratchet and ratchet-wheel. A crank disc at the end of the first motion shaft communicates, by means of a connecting rod and lever, a reciprocating motion to a horizontal shaft underneath the machine; a lever on this shaft carries a forked casting, in which the two needles, working vertically through slots in the table of the machine, are fixed. Reciprocating motion is also given to two hooks which work above the table, and which engage in the loops of string brought up by the needles, in such a manner that when the needles have passed upwards through the straw, and have begun to return (the string at that moment being slack), the hooks move forward and engage in the string, retaining it in the form of a loop until such time as the needles again ascend, passing through the loops. After this, the loops are released by the reverse motion of the hooks, which subsequently move forward, and again catch the string from the needles, just as they have begun to descend; thus forming fresh loops, and so on. The machine will take any length of straw, and is capable of turning out about 300 feet run of thatch per hour. The bundles are cut off in lengths of about 11 feet, as being most convenient to handle, and it is found that with an average length of straw and enough necessary to overlap, about $3\frac{1}{2}$ bundles are required to make one square of finished

thatching. The amount of string used appears to be as nearly as possible 1 lb. per 100 feet run. Having a trial, we had the thatch made from ordinary trusses of straw from the thresher, and on completing a certain quantity, had it placed on to a stack prepared for the purpose close by. It was evident that the man was an adept at his business in the putting on, and he in a very short time covered a portion of the stack, pegged it, and completed the work in a most satisfactory manner. According to our calculation, at a rough estimate, this man with the use of the machine could prepare and put on the thatch for eleven pence per square. And the thatch so knitted together, by the stitching and the lengths used with the ordinary pegging we saw applied, would, it appears, almost defy any wind to disturb it. The prize of 25*l.* was awarded to this machine.

The single exhibit entered in Class 4 calls for no remark.

Messrs. Smith and Grace, No. 1339, Convertible Belt Pulley.—The principal feature of this patent is to enable the same pulley to be used for different sizes of shafting, and more perfectly and easily fix the same without kerp ; this is accomplished in the following manner, which will be understood by reference to the sectional drawings (Fig. 1—A to C):—The holes of all

Fig. 1.—*Illustrating Messrs. Smith and Grace's Convertible Belt Pulley*, No, 1339.



the pulleys are bored slightly taper, and screwed to a uniform size and gauge (A). A bush is inserted into the hole of the pulley to fit the size shaft for which the pulley is required ; the bushes are screwed externally to a uniform size and gauge,

slightly taper, consequently the more work there is put upon the pulley by the belt the tighter the bush grips the shaft. The bushes are in four parts, held together by a piece of stout emery cloth, thus forming a hinge at the joints, which enables the bush to be opened and placed upon the shaft (B), and adapts itself to the shaft (C). The bush is practically a four-hollow kerp threaded upon the outside, the pulley being screwed upon the kerp, instead of the kerp being driven into pulley. Fig. 1 represents a pulley and bush on the shaft ready for fixing. The pulley has simply to be screwed on to it, without either kerp or key beds—the bush fits the shaft properly, and the pulley will run true. The advantages claimed by the patentees are these: first, the same pulley will fit any size shaft with merely an alteration of the bush, and can be changed if necessary from one shaft to another. This is a great convenience, and saving in mills and works where large numbers are used; secondly, should the shaft vary either or under the standard sizes, the pulley will fit equally well, neither tools nor skilled workmen being required to fix it, and it cannot get loose in work. The pulleys are manufactured in cast-iron, and with steel rims. A specimen, 36 in. diameter by 24 in. wide, with double arms, was exhibited at Norwich, and reflected great credit upon the manufacturers; we were also informed by the makers that, encouraged by success, they have erected special machinery for their manufacture, enabling them to be offered to the public at the same price as ordinary pulleys. To this article a silver medal was awarded.

Messrs. William Rainforth and Sons, No. 762, Corn Screen. —This, a rotary self-cleaning corn screen, is constructed upon quite a novel principle—a cylinder of wire revolving within a fixed wire concave or cradle. This screen is so constructed, that the fullest range of alteration of mesh can be obtained easily, and with the greatest degree of nicety to any size required—simply by an angular movement of a handle. Moreover, the extreme length of the screen can be used for screening purposes, irrespective of any alteration of mesh; it is self-cleaning, and the need of brushes or any other cleaning contrivance hitherto used is thus dispensed with. Messrs. Rainforth have kindly given the following descriptive account of the construction of this screen, and the principal improvements it presents, and the detailed engravings, well illustrate this description:—"The improvements have special reference to self-cleaning screens, and consist essentially in combination with a rotary self-cleaning screen having a fixed mesh and a fixed length and diameter, with a stationary adjustable segmental cradle; also having a fixed mesh and length, but capable of

adjustment as regards its diameter in such a manner as that it can be distended equally at all parts of its surface from a diameter, less than or equal to that of the screen, to a diameter

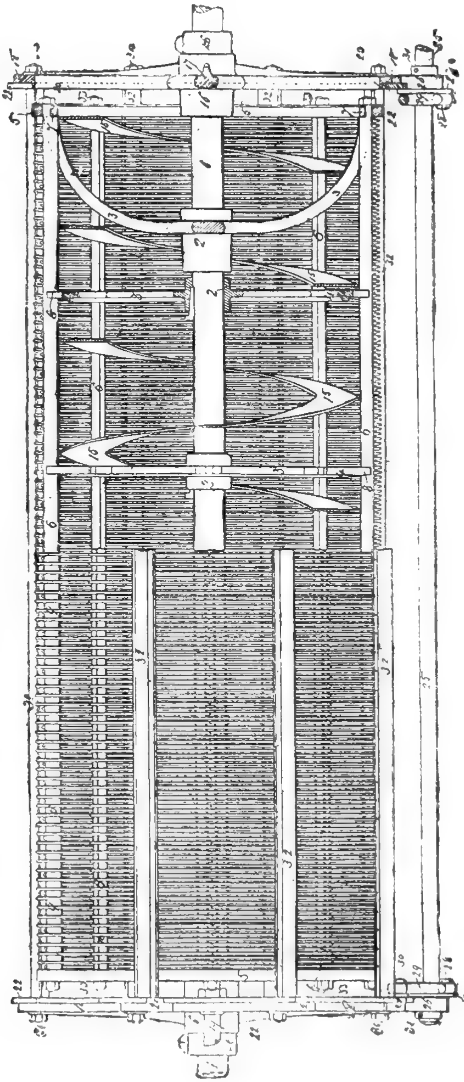


Fig. 2.—*View of Messrs. Rainforth and Sons' Corn Screen, No. 762.*

equal to it, as may be required. (1.) The wires of the screw and of the cradle alternate. (2.) The smallest mesh between the adjacent wires is existent when the screen and cradle are

in the position of equal diameter, and their circumference are coincident. (3.) The radial distension or the radial collapse of the cradle to an equal extent at all parts of its surface, has the

Figs. 3 to 6.—*Sections of Messrs. Rainforth and Sons' Corn-screen,* No. 762.

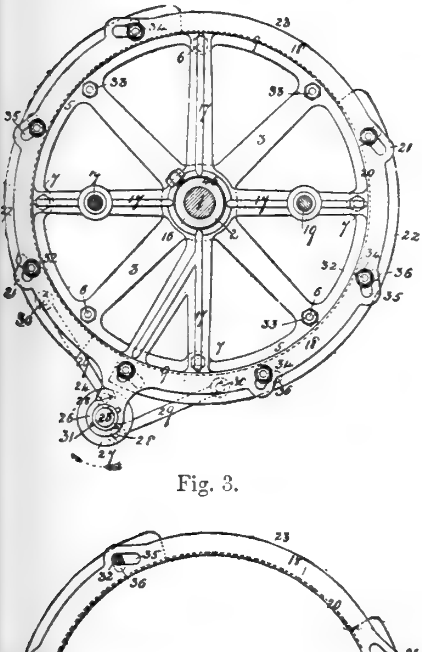


Fig. 3.

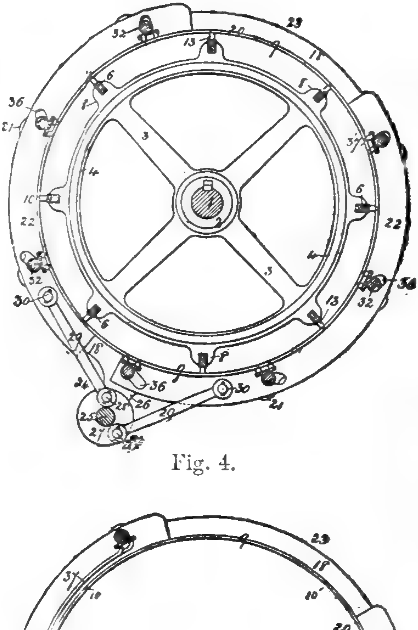


Fig. 4.

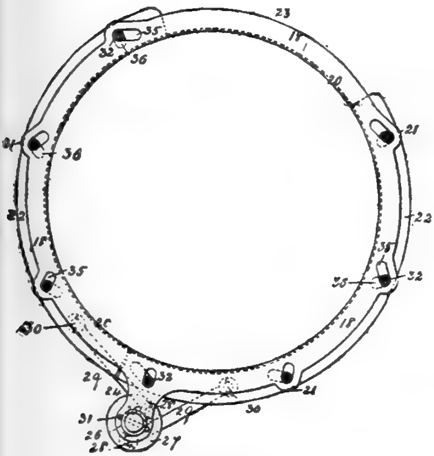


Fig. 5.

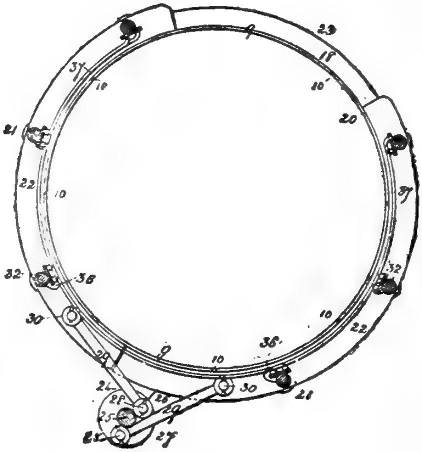
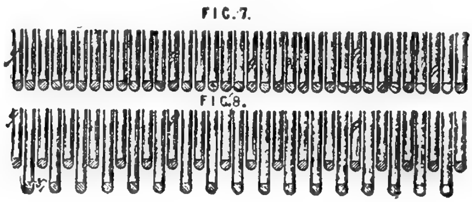


Fig. 6.

effect of increasing the mesh between the adjacent wires of the screw; and of the cradle to an equal degree at all parts of the

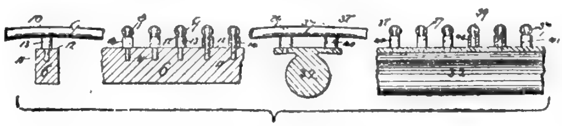
screening surface, and to any extent or degree required between its minimum and maximum mesh, this being dependent upon the diametrical or radial extent of distension or collapse given to the cradle, and to secure that the wires of the screen and of the cradle occupy parallel and concentric positions about the centre of rotation of the screen irrespective of their several relative distances apart. It is essential to the invention that the wires of the cradle should always occupy a position exactly bisecting the spaces between the wires of the screen, so that whether the spaces between the wires of the latter be equidistant, or vary throughout the length of the screen, the mesh at any one time and at any one position of the cradle may be the same, or gradually

Figs. 7 and 8.—*Illustrating Positions of Wires in Rainforth and Sons' Corn-screen.*



and equally increasing throughout the length of the whole screening surface. This result may be obtained either by varying the wires of the screen alone, or by correspondingly varying the wires of the cradle alone." This screen (No. 762), to which was awarded a silver medal, was an 18 in. by 4 ft. 6 in. length, priced ten guineas. By an examination of the figures it will be seen how exactly the screen and the cradle in requisite combination secure the purpose of the inventor. Fig. 2 represents

Fig. 9.—*Illustrating the Mounting of the Wires in Messrs. Rainforth and Sons' Corn-screen.*



in part a side or external view, and in part also a sectional or internal view of the screen. Fig. 3 represents an end view of the exit end of the screen, illustrating the position of the parts, when the cradle is in its innermost position, giving the smallest mesh between its wires and the wires of the screen. Fig. 4 represents a transverse section of the screen and cradle

when in the position of Fig. 3. Fig. 5 represents an end view corresponding to that of Fig. 3, to represent the means of operating the cradle, and illustrating the position of the parts when the cradle is in its most distended position, giving the largest mesh between its wires and the wires of the screen. Fig. 6 represents a transverse section of the screen and cradle when in the position of Fig. 5. Fig. 7 is a transverse section of the wires of the screen and of the cradle when at their least distance apart, when the parts are in the respective positions illustrated in Figs. 2, 3, and 4. Fig. 8 represents a view, corresponding to that of Fig. 7, when the said wires are at their greatest distance apart, and in the respective positions illustrated in Figs. 5 and 6. Fig. 9 represents detail sectional views illustrating methods of mounting the wires of the screen and of the cradle upon their several supporting bars or rods.

The Aylesbury Dairy Co., Limited, No. 903, Patent Ensilage Stack Press.—A Silver Medal was awarded to this Company for an improvement on Mr. C. Johnson's Patent Ensilage Stack Press. Mr. Johnson obtained the prize of 25*l.* given by the Royal Agricultural Society for the best stack or other system of obtaining silage without a silo in England and Wales, in actual work during the winter of 1885–6. In vol. xxi., part 2, of the Society's Journal (page 729), a description of Mr. Johnson's press is given; but since then a great improvement has been made in the mode of applying the pressure, the use of screws being entirely abandoned, on account of their action being slow and the friction great, and a ratchet and lever being substituted. For this improvement (Fig. 10) the Judges have awarded the Silver Medal of the Society. As at present supplied, the gear consists of a series of cross-heads moving loosely up and down on ratchet bars made fast to logs of wood placed transversely beneath the stack. To these cross-heads is attached a flexible galvanised steel rope, laced backwards and forwards, at regular intervals over the top of the stack throughout its entire length, and which really forms a kind of rope saddle. The following illustration (Fig. 10) shows the ingenious arrangement of ratchet and pawl, by means of which the cross-heads are drawn down, tightening the rope, the length of leverage being so adjusted that every stroke of the lever moves the cross-head down three-quarters of an inch, and a man pressing with the weight of 8 stone puts 3 tons on each cross-head, so that a stack 16 feet wide has a pressure of 200 lbs. per square foot. The lever and pawl are fulcrumed in position on the socket provided to receive the former, and from which it can be lifted and carried from one cross-head to another, so that one lever and pawl are sufficient for any number of cross-heads;

the pressure obtained is most effective and complete, and is exercised at the side as well as the top, leaving the latter

Figs. 10 and 11.—*Illustrations of 100-ton Stack, constructed on Mr. C. G. Johnson's Principle.*

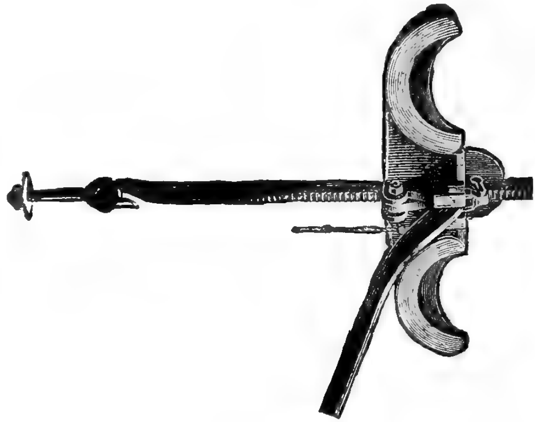


Fig. 10.—New Ratchet and Pawl Arrangement.

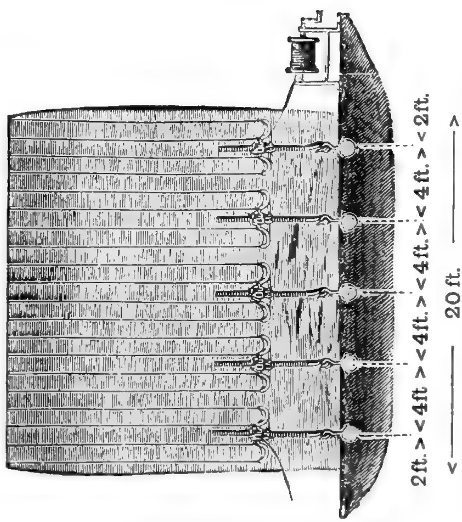


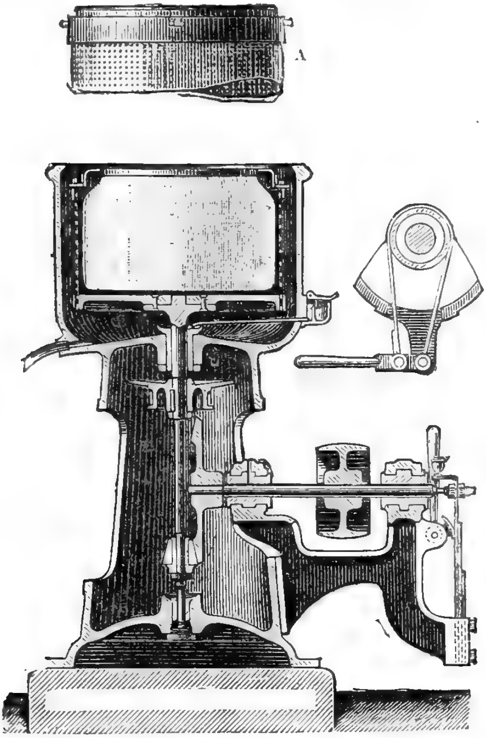
Fig. 11.—Length view of 100-ton Stack.

rounded. The stack is then thatched over the wire rope, and has the appearance of an ordinary hayrick.

The Working Dairy (*Note supplied by the kind assistance of Mr. F. S. Courtney, Engineer*).—The greatest mechanical novelty in the Working Dairy this year was the "Délaiteuse," or Centrifugal Butter Worker, which was exhibited by the Dairy Supply Co. (Limited) and to which a Silver Medal was awarded. This is a French invention for separating milk

from the butter, on the same principle that the centrifugal machine used in sugar refining expels the water from sugar. The machine (the invention by M. Baquet) consists of a perforated cylinder (A), mounted on a vertical spindle, and driven by means of friction cones at a suitable speed. The sectional illustration (Fig. 12) shows clearly the details of the machine. Two sizes of these machines were exhibited; one meant for large butter factories, and driven by power, capable of treating

Fig. 12.—*Section of M. Baquet's Délaiteuse.*

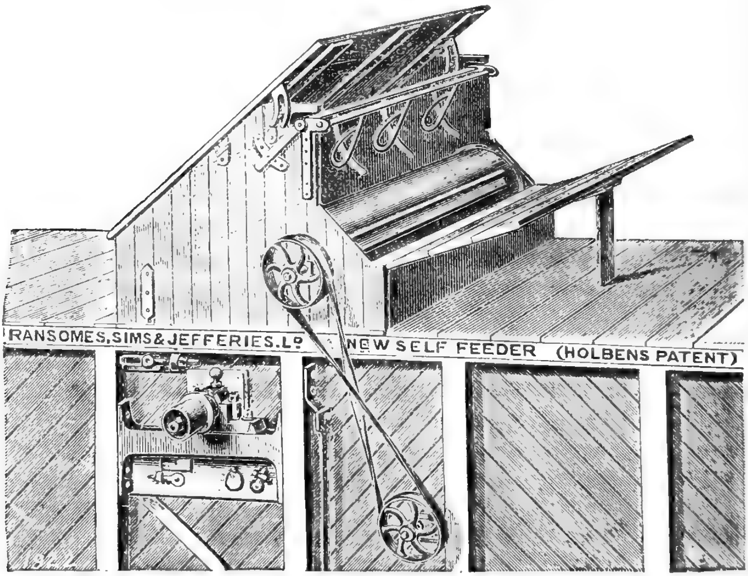


16 lbs. of butter at a time (of which the illustration is a section); the other for small dairies, worked by hand, taking 8 lbs. of butter. The butter, after leaving the churn, and while in the granular state, is placed in a thin canvas bag, fitting inside the perforated cylinder, which is made to revolve at about 1800 revolutions per minute; the centrifugal force being then sufficient to drive the butter-milk outwards through the granular particles of the butter into the space between the perforated

cylinder and the outer case, from which it escapes by means of a waste-pipe, the butter being left firm and dry; the time occupied is not beyond four minutes. The efficient working of this machine depends largely upon the condition in which the butter is introduced.

Messrs. Ransomes, Sims, and Jefferies, No. 3848, Threshing Machine, with Self-acting Feeder.—This feeder consists of a revolving cylinder, fitted with two longitudinal wood projections, driven by a strap from a pulley on the end of a straw-shaker crank.

Fig. 13.—*Self-acting Feeder attached to Messrs. Ransomes, Sims, and Jefferies's Threshing Machine*, No. 3848.

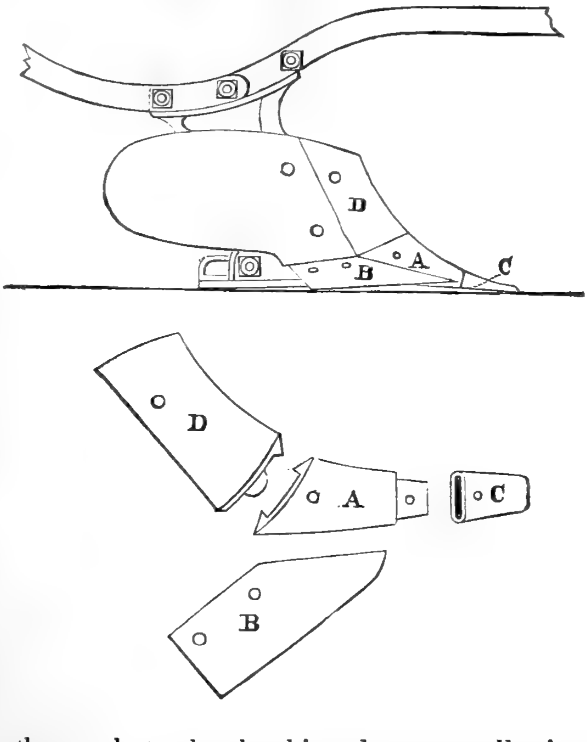


Above the revolving cylinder is a fixed shaft carrying three curved tines, and an oscillating shaft carrying loop-shaped tines. The looped tines move backwards and forwards, close behind the fixed curved tines, and are driven by a connecting-rod and crank from the cylinder spindle. Both the curved and the looped tines can be adjusted to suit all kinds of corn, beans, peas, &c. The cylinder and tines are enclosed in a wood casing and fixed above the drum mouth of the threshing-machine, forming a complete protection to the threshing drum. The operation of the self-feeder is as follows: the bands of the sheaves being cut, the corn is placed upon the inclined board, which directs it to the revolving cylinder, which carries it

forward to the threshing drum, whilst the looped and curved tines assist in so separating the straw, that an equal and continuous stream, directed by an internal swinging plate, is conducted to the threshing drum.

This feeder is very simple in construction and can be easily managed. It is applicable to any steam threshing-machine, and can be quickly moved when desired. The feeder does not interfere with free access to the working parts of the machine, and is so arranged that the shutters and doors can be easily opened. The advantage of this feeder is, that it enables an inexperienced man to feed the thresher, as the corn may be forked into the hopper, the feeder being so constructed that it

Fig. 14.—*Illustrations of Messrs. Ransomes, Sims, and Jefferies's Digging Plough*, No. 3849.



regulates the supply to the threshing drum, not allowing it to get too much or too little, hence a more uniform feed is provided, an important matter, saving that strain which is too frequently seen by ordinary feeding. With this self-feeder all

the after-operations of the machine, which are taken from the drum spindle, are kept at a uniform speed, and consequently are always operating as they should be. The feeder also forms a safeguard round the drum, and, taking up very little room, does not in any way interfere with the ordinary platform of the machine. To this article a silver medal was awarded.

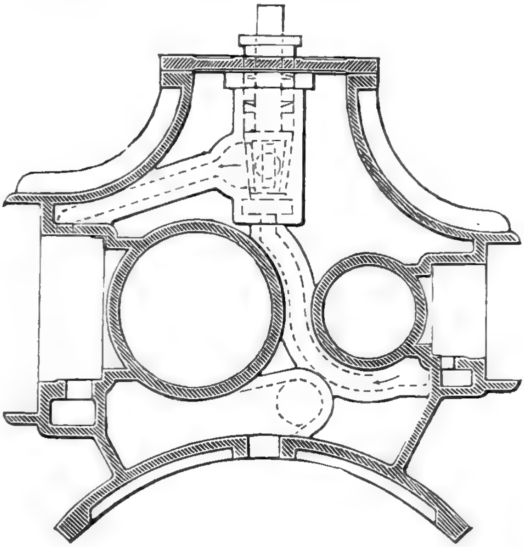
Messrs. Ransomes, Sims and Jefferies, No. 3849, Digging Plough with Patent Divided Share.—This plough, adapted for digging work, is fitted with a new Plough Share, patented by Mr. James Edward Ransome, grandson of Mr. Robert Ransome, founder of the firm, which, instead of being made, as is usually the case with shares for digging-ploughs, of one heavy casting, is divided into four parts, so that those parts most accustomed to wear can be more cheaply renewed. The share consists of a box, Fig. 14, p. 539 (A), to which is fitted a point (C), forming the point of the share, the wing (B) forming the bottom cutting blade, also the cutter (D) which serves as a coulter, and which is held in its place by a projection in the fore part that fits into the box. The wing of the share is supported by a groove in the box, and is held in position by two bolts attached to the frame of the plough, so that it is not liable to breakage; and the roots of weeds, twitch grass, &c., cannot get between it and the bottom part of the share.

Messrs. Foden and Sons, No. 3976, Compound Traction Engine, fitted with their spring sliding axle-box, is provided with a special arrangement by which the compound actions may be instantly suspended, and both cylinders may take high-pressure steam, exhausting directly and independently into the chimney, the steam being supplied in such a manner that each cylinder shall give off the same amount of power. The object of such an arrangement is to give increased power to the engine when starting or doing exceptionally heavy work, as on a steep gradient or when getting over soft ground. It is effected in the following manner: in the passage between the high- and low-pressure cylinder, a three-way cock is fitted, this cock being actuated either by an independent lever or else by the starting lever. In ordinary work, the steam from the high-pressure cylinder passes into the larger (or low-pressure) cylinder, is there further expanded, and exhausts therefrom into the funnel.

If, in case of emergency, it is required to get more power out of the engine, the above-mentioned three-way cock is opened, so that the exhaust from the high-pressure cylinder passes direct into the chimney, which relieves that cylinder of the back pressure due to working the low-pressure cylinder, and consequently increases its power. Live steam is at the same time admitted into the low-pressure cylinder; but as this cylinder

is so much larger than the high-pressure one, it is obvious that if steam of equal pressure were admitted to both cylinders, the larger one would do the most work, and consequently the engine would run unevenly. To overcome this, a steam-reducing

Fig. 15.—*Section of the Three-way Cock of Messrs. Foden and Sons' Compound Traction Engine*, No. 3976.



valve is provided in the passage to the low-pressure cylinder, by which means the power to each cylinder is equalised, and the engine works as an ordinary double-cylinder high-pressure engine.

Messrs. Aveling and Porter, No. 2, Agricultural Traction Engine.—This, an 8-horse power agricultural traction engine, is fitted with an improved steel fore-carriage, and a new arrangement of steering-gear. The fore-carriage is made of two steel plates, which are flanged on a disc in a hydraulic press, so that they approximately assume the form of a double-hollow cone, in the larger portion of which is fitted the cast-iron swivel block which carries the fore part of the engine; whilst into either end, the axles of the wheels are securely fitted and riveted in. The steering-gear consists of a geared segment, carried by two steel-flanged brackets, fixed under the boiler on the front plate of the water space surrounding the fire-box. This segment is worked by means of a worm-wheel spindle and hand-wheel in the usual way from the foot-plate. From either end of the segment,

steering-rods extend to the fore-carriage, taking the place of chains in former arrangements. The gear is very compact, and obviously gets over all question of slackness of the chains. The firm also exhibited one of their 8-horse Road Locomotives, fitted with their patent spring wheels. These wheels have been exhibited at previous Shows, and have satisfactorily stood the test of time. The wheel consists of an inner and an outer tire. The outer tire consists of two $\top$-irons riveted together ($\underline{\perp\perp}$) by means of the diagonal plates round the outside of the wheel; the inner tire, of smaller diameter, consists of two iron rings securely riveted to either side of the end of each spoke, and fits loosely into the channel formed with the two $\top$-irons; thus the inner tire is connected with the boss of the wheel revolving with it. To communicate motion to the outer tire the latter is connected by spiral springs, connected to the end of each spoke, and also attached to brackets on the inside of the outer tire. These springs act together both in compression and tension.

On the wheels of the engine exhibited there were 8 spokes, with springs to each. Messrs. Fowler, of Leeds, have adopted this system of springs for their traction engine, and exhibited one of them thus fitted.

Messrs. Marshall and Sons, No. 3910, Threshing-machine.—In order to diminish the number of working parts and bearings in a threshing-machine, many of which are difficult of access, Messrs. Marshall have made improvements in this machine, in which the straw shaker is driven direct from the vibrating shoes of the machine, these shoes being actuated by one crank under the drum (which is the only crank in the machine). The shakers are suspended by wooden springs outside the machine.

By this arrangement it is claimed that 2 cranks and 12 rotary bearings, with corresponding oiling places, as well as a driving belt, are dispensed with.

Such a reduction in the number of moving parts should materially diminish the amount of power required to drive the machine.

Messrs. J. and F. Howard, No. 3205, Arc-axle Plough.—In this plough, which is an entirely new invention recently introduced by this well-known Bedford firm, are combined the advantages of the loose fore-carriage and of those attaching to fixed wheels. These objects are accomplished in a simple and efficient manner. In the first place, by arching the axle carrying the two wheels, and upon which arched axle is mounted a sliding block or bearer piece carrying the forward end of the plough beam. The shifting of the block along the arc regulates the position of the fore-carriage for working

at any depth, whilst maintaining the vertical position of the plough. A gauge-plate maintains a proper distance between

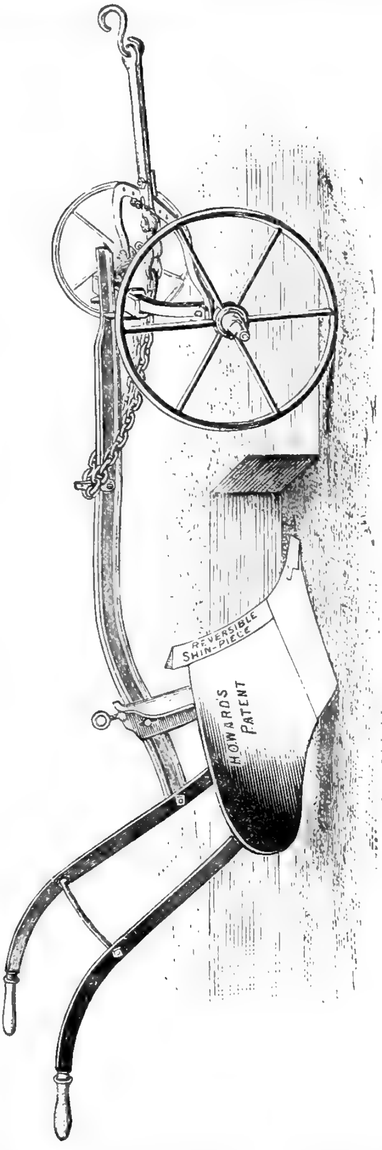


Fig. 16.—*Messrs. J. and F. Howard's Arc-axle Plough, No. 3205.*

the beam and furrow-wheel, so that any variation in the width of the furrow during work is prevented. The loose fore-carriage

is connected to the plough in a novel manner:—by passing a chain over the top of the beam, and under the arched axle to the end of the draw-bar where the two ends of the chain are connected, a frictional contact between the beam and the bearer is produced immediately the horses begin to draw; the more or less rigid impact, thus set up, firmly secures the beam to the fore-carriage as effectively as though they were riveted together, the result being that the plough will go without being held. The necessary pitch or inclination of the share is obtained or varied by a top screw and slot in the plough body. The improvements claimed in the "Howard Arc-axle Plough" are simplicity in construction, great strength combined with little weight, also clearance for ploughing-in manure or surface vegetation. The arched axle and the inclination of the furrow-wheel give plenty of clearance underneath; and the cutting or coulter edge being on the right or furrow side of the beam, nothing lifted by the share and mould-board can choke the throat of the plough. The line of draught is got by curving the beam to the required point, the ordinary plough-hake being replaced by a bow on which the draught-bar slides, to regulate the line of draught according to the width of furrow. The whole of the wearing parts of the plough—mould-board, landside plate, share with reversible point, and new reversible shin-piece or cutting edge on the landside which answers the purpose of the usual knife-coulter—are all made of chilled-iron, and are consequently very durable. The beam is of I-section, and, like the body, is of wrought steel. The fore-carriage, dispensing with the customary standards, beam-slides, loop-screws, and clips, is free from all liability to damage by rough usage, or wearing loose.

This plough we had tried, and the work done was excellent, the furrow, 7 by 13, leaving the work in the most satisfactory manner, perfectly disintegrated and level, with evident ease to the pair of horses, which, according to the width of the furrow, could plough two acres per day. It was also tried as a skim-plough with equally satisfactory results. The price (3*l.* 15*s.*) appeared moderate.

Messrs. J. and F. Howard, No. 3258, Rix's Self-Lubricator.—This invention, patented by Mr. Nathaniel Rix, of Colney, St. Albans, relates to improved means for automatically and continuously lubricating spindles or axles, or similar rotating parts of machinery, and consists in providing a bearing constructed (as is described) with a recess or chamber (one or more) for containing the lubricating material, in combination with a rotating ring, collar, or lifter (one or more), arranged upon the axle, spindle, or shaft, in such a manner as to enter

and rotate within the chamber, and lift and distribute the oil or lubricant upon and along the said axle, &c. In carrying this invention into practice, a bearing is provided, being of any desired shape or configuration, and at each end of the same a recess chamber is furnished for containing a supply of oil. Upon the spindle shaft or axle, which is to rotate within the bearing, collars or rings are provided, which are so located as to dip into the oil-chambers, and to rotate therein with the spindle, the latter lying partially within the recess, which is continued completely around the bearing, viz., in the upper as well as in the lower portion thereof, so that the ring or collar can rotate freely. The collar or ring is made bevelled, or inclined, on its inner surface, so that the oil, as it is raised from the lower portion of the chamber, will be directed towards and along the portion of the spindle requiring to be lubricated; and one of these collars or rings being at each end of the bearing, the oil will thus be directed along the spindle simultaneously, and be an effectual lubrication whilst the spindle is rotating. The rings or collars may be fixed tightly upon the spindle, or may be somewhat loose.

Messrs. E. Page and Co., No. 1711, Brick and Tile Machine.—Amongst an important exhibit of brick-making machines, this firm show, under the title of a "New Implement," one of their Brick, Pipe, and Tile Machines, fitted with new self-acting gear, which claims to dispense with the services of one man. The machine itself is an ordinary horizontal press, which may be fitted with dies for bricks, pipes, or tiles, with quick return motion.

The action of the machine may be thus described. The clay is filled into a box with a close cover (Fig. 17), in which a plunger (B) works horizontally, pressing the clay through the dies in the front side of the box, where it is delivered on the ordinary roller platform, to be cut into proper lengths for either bricks, tiles, or drain-pipes. The horizontal plunger (B) is actuated by means of two racks (C), on one of which a stop (D) is bolted, which at the end of the forward movement engages against a roller, in connection with a lever (E), which shifts the strap fork (F), directing the strap from the fast to the loose pulley; a clutch (G) is then thrown out of gear, and the machine is in a position to return to the quick motion.

A balanced lever at the end of the machine acts as a safety catch, and effectually prevents any liability to accident during the absence of the attendant.

In addition to the above automatic arrangement, a hand-starting lever (H) is provided, by means of which the machine may be controlled at any point of its stroke.

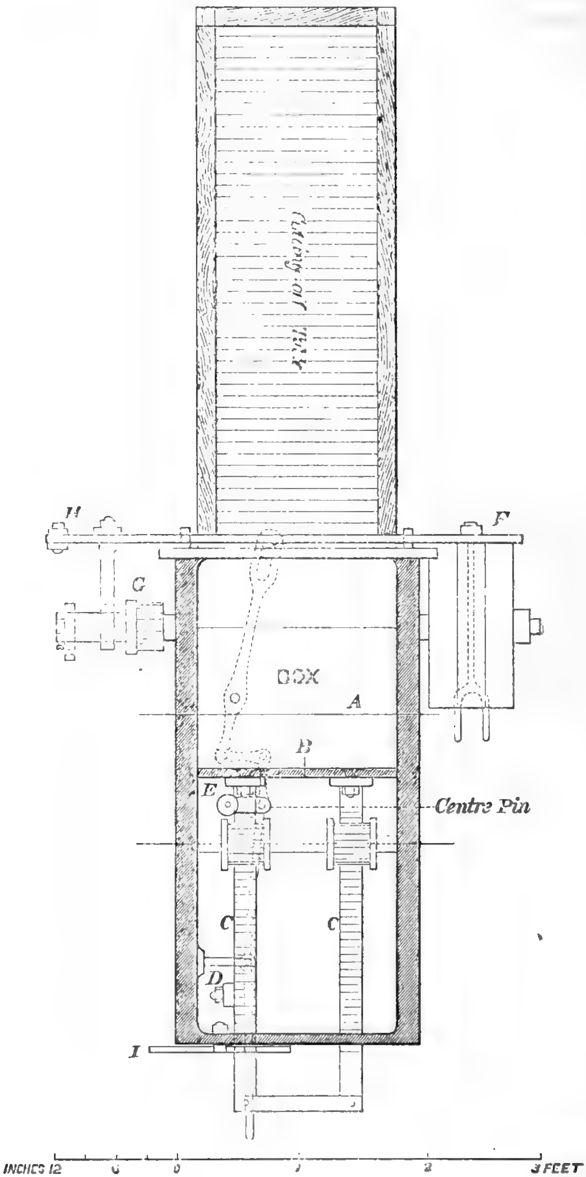


Fig. 17.—*Plan of Messrs. E. Page and Co's. Brick and Tile Machine, No. 1711.*

The self-acting gear may be attached to any of the hand machines manufactured by this Company, or by the Bedford Iron Works, which both belong to the same proprietary.

Messrs. Chadborn and Caldwell, No. 2331, Excelsior Drill.—This drill professes to be adapted for sowing every kind of grain and seed, also for dealing with artificial manures of every kind. The general construction of the drill will be apparent from the following description. The frame is made of the best American maple; the travelling wheels are of large diameter; the seed and manure boxes are mounted by means of angle brackets well above the frame; the lids close quite watertight, and by a

Fig. 18.—*Sectional view of the Grain and Seed-box of Messrs. Chadborn and Caldwell's Excelsior Drill*, No. 2331.

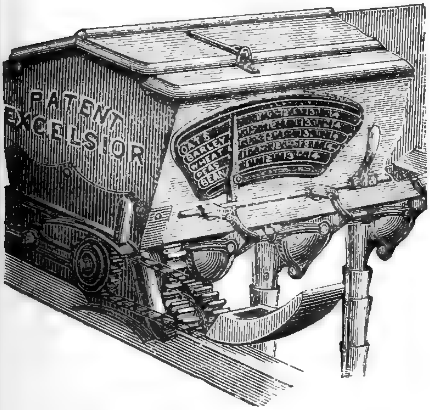
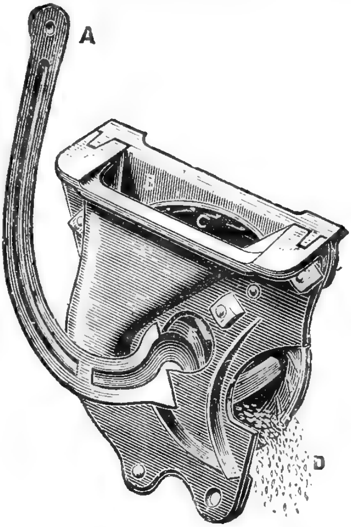


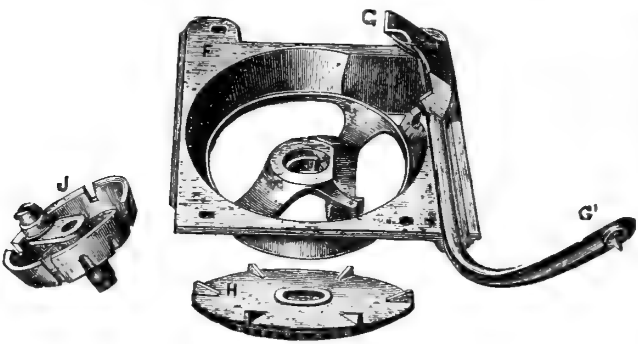
Fig. 19.—*Distributor of Messrs. Chadborn and Caldwell's Excelsior Drill*, No. 2331.



peculiar form of cranked and recess hinges, one can be opened and shut independently of the other. The axle, which carries the travelling wheels and supplies the primary motive power, is made of steel; it is connected with the wheels by ratchets, and each wheel is free to move independently of the other; at the same time, both or one only can drive the whole of the distributors, giving a double driving power and steady motion to the distributors, which is an advantage. A smaller kind of box is used for sowing grass and clover seeds; this can be fitted in front or behind the drill, and driven by a linked belt from a sprocket wheel on the main shaft. Fig. 18 gives a sectional view of the grain and seed box. Fig. 19 (A) represents the dis-

tributor itself, of which eight, nine, ten, or more, can be fitted into the bottom of the seed box; the framework consists of two moulded castings, which are bolted together, and form the chamber (B), in which is a saucer-shaped distributor (C) with ribs; this, keyed on a main shaft revolving vertically, delivers the seed at the outlet (D) into the funnels and coulters to the ground. The outlet at D is controlled by an adjustable partition (E), which is connected at the extremity (A) with a coupling rod, at the end of which is a pointer, which, when set by the gradations on the dial, correctly indicates the quantity being sown per acre. The construction of one manure-box (Fig. 20) will serve as a sample of the whole. A square frame (F) is screwed into the bottom of the manure-box, below which runs a steel shaft, carrying a small bevel wheel for each distributor;

Fig. 20.—*Illustrating the Construction of a Manure-box in Messrs. Chadborn and Caldwell's Excelsior Drill*, No. 2331.



(H) is a large feed-wheel, which revolves into the bottom of the frame (F), and gears into the small bevel wheel mentioned, from which it receives its horizontal rotary movement. The scrape wheel (J), which is carried by the feed wheel (H), and by their combined rotary motion, *i.e.*, the scrape wheel, revolving with and *upon* the feed wheel, take hold of and force every particle of the manure, be it dry or sticky, through the opening controlled by the gate (G) down into the tubes, and through the coulters into the ground. The arm of the gate (G, Fig. 20) is at the point (G 1) connected with a coupling-rod, which is, like the seed-box in front, provided with a dial and pointer, and the opening at G in each of the distributors being adjusted to drill any quantity from 1 cwt. upwards per acre as may be needed. There is also a simple arrangement of shut-off slides, which can be used at will. They claim as an important feature in this drill, that its patent "spring coulter" effectually overcomes any diffi-

culty from the contact of stumps, stones, &c. This new form of coulter is self-adjusting, and dispenses with wooden pegs, pressbars, and weights. The exhibitors also drew our attention to what they consider a great improvement over other drills, namely, the absence of loose wheels to change, and gears to be altered for every change of seed, or varying consistency of manure; and these, coupled with the fact of there being no shifting pinions or parts liable to be lost, form great advantages. Another feature which this "Excelsior Drill" presents is a patent Automatic Land-measurer, furnished with a pointer and actuated by a worm pinion in connection with the main axle, which will indicate the number of acres drilled during the day.

Messrs. Hornsby and Sons, Double Plough, No. 3122.—This plough was sent into the field for trial, and for the Judges to see it work. The ridge was set with the plough and ploughed a piece of land, 7 inches deep and 24 inches wide, each furrow being 12 inches wide, with a pair of horses, with ordinary breasts, ploughing 6 inches by 8 inches, and leaving a furrow at an angle of 45°, and making good work. The ordinary breasts were taken off, and digging breasts were put on, and ploughed a furrow 7 inches by 12 inches, breaking the land thoroughly, and leaving it level and even on the top, in a condition ready for the drill. Though a pair of horses did the work, they could not reasonably be expected to remove this amount of soil, and to perform the perfect disintegration which the plough did. Another horse might have made the plough appear to be easy of draught. The plough was entirely under the control of the man riding upon it, turning in and out of work at the ends with the greatest ease, merely turning the handle to the right or left. It needs no larger headland than an ordinary plough.

In taking the plough out of work, the action of the newly improved lift could be clearly seen. This consists of a duplex lever, the lower handle of which fixes the position of the large land-wheel whilst the implement is in work. On arriving at the end, a pull is given to the upper handle, which has the double effect of lowering the large land-wheel and the small carrying wheel on the opposite end of the cranked axle, and also of locking the large wheel, thus forming a stationary point of contact with the ground. The forward motion of the horses lifts the bodies clear out of the ground; the same duplex lever, coming into contact with a pin at the end of the bracket on which it moves, locks the crank-axle so as to retain the plough out of work, and at the same moment unlocks the large land wheel, so that the plough may travel as far as desired.

The wheels are of a new kind, being fitted with inside chilled bush and renewable wrought axles. The patent parallel straightening bridles enable the ploughman to straighten at

will with greater ease than by handles. The anti-friction principle is most fully carried out, giving lightness both in draught and weight, with increased power and efficiency in work.

The depth of the furrows can be regulated from 3 inches to 8 inches, and the width from 7 inches to 13 inches. It may be fitted either with general purpose or with digging breasts and shares, and a pair of handles for setting out ridges can also be had if desired.

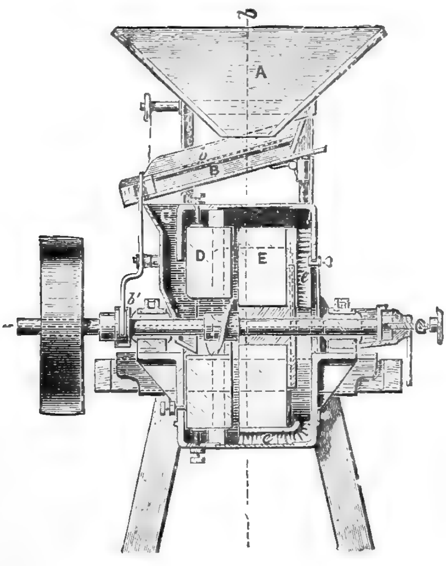
Messrs. R. A. Lister and Co., No. 827, Corn-Grinding Mill.—This mill is adapted for grinding meal for stock, but also for preparing flour for domestic purposes. The grinding part is this firm's ordinary "Vertical stone mill," carried by two brackets which are bolted on to the dressing part. The corn passes first from the hopper into the shaking-shoe, in which is fixed a wire screen to collect any stones, sticks, nails, &c., before it passes into the mill. The stones being vertical, the corn passes from the shaking-shoe into an opening on to a worm, which is keyed on the shaft which carries the runner stone. Being thus deposited on the face of the stone, it is ground and passes into the separator, producing three different degrees of fineness of flour and bran. The dressing apparatus consists of a circular barrel covered with graduated brass-woven wirework, in the centre of which revolves a brush with three arms, driven by a strap on the mill-spindle. In case of no need of any separation, a tipping-plane is provided that will turn the meal into a sack or bin without passing through the dresser. The cost of this mill is 25*l.*, and it is capable of grinding and dressing from 6 to 8 bushels of fine meal per hour, and requires only a 3 or 4 horse-power gear, worked by steam or water power. The stones are easily taken apart for dressing. Messrs. Lister have recently taken out a patent for bolting the fixed stone to the iron casing, also for putting the runner stone in a pan with angular and spiral ribs cast on the outside, causing the stone to be perfectly balanced, and at the same time producing a current of air, essential for cooling the meal and keeping the cases perfectly clear. No. 828, exhibited also on this stand, is a small mill on the same principle, worked by hand for domestic purposes.

The Albion Ironworks Co., No. 2491, Pulper or Shredder and Slicer.—The chief novelty of this machine, made on the disc principle, is the adaptation of a single disc wheel to the separate and distinct operations of pulping or shredding, and of slicing all kinds of roots, and by the addition of grass-cutting plates it also makes a very efficient fingerer, thus constituting a simple treble-action machine. In all other machines of this class two or more discs are required, and this adds to the cost. The knives, patented, are of a special shape, four for pulping or

shredding and two for slicing or fingering; they are attached to the face of the disc by bolts and are provided with slots, thus admitting of adjustment to compensate for wear; the slicer knives can also be readily altered to vary the thickness of cut. The disc is mounted vertically on a strong iron spindle, and is fixed in a capacious feeding hopper. When the wheel is turned in one direction the roots are pulped; and by simply reversing the motion, clean-cut slices or finger-pieces are produced. A reversible grating inside the hopper turns over to guide the roots in the proper direction for cutting, and the requisite angle in the pocket, necessary to hold the roots when being cut, is obtained by a self-acting swing-plate attached to the main spindle. No alteration of the position or setting of the knives is required, this objection in all other machines being entirely obviated. The special advantages claimed are, increased efficiency, combined with simplicity of construction, enabling the manufacturer to offer the machine at a much lower price than other machines made for these purposes. Price 4*l.* 2*s.* 6*d.* These are great advantages in a hand machine, but are not so applicable to machines driven by steam-power.

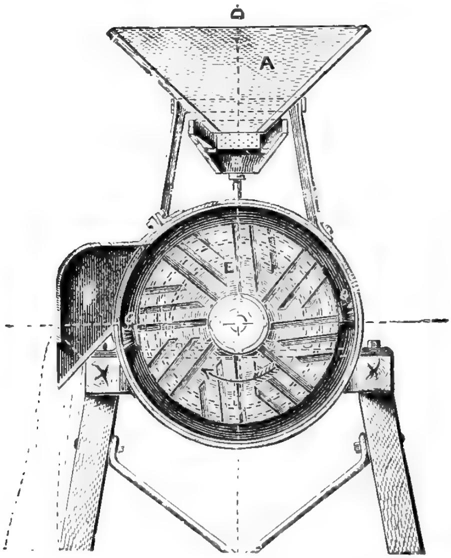
Messrs. Jeffery and Blackstone, No. 2321, "Corn Grinding Mill."—This mill is fitted with vertical stones, the bed or fixed stone (D, Fig. 21) being attached to the casing of the machine

Fig. 21.—*Section of Messrs. Jeffery and Blackstone's Corn Grinding Mill,* No. 2321.



by means of clamping screws, and the rotating stone or runner (E) to a rotating shaft; the corn is placed in the hopper (A) or the top of the casing, and is thence conveyed to the eye of the fixed stone, through the shoot (B) and feed spout (C). This shoot is provided with a riddle, to prevent any substance other than corn from entering the mill; but in case a hard substance, as stones or nails, should by chance not have been prevented, springs are supplied, to allow the stones to move apart, and make way for the hard substance to pass. On reaching the eye of the bed-stone, the grain comes in contact with a worm attached to the mill shaft, delivering it to the furrowed grinding surfaces, there reduced to the required consistency, and dis-

Fig. 22.—*Cross Section of Messrs. Jeffery and Blackstone's Corn Grinding Mill,* No. 2321.



charged into the case. The running stone (Fig. 22, E) in this mill is fitted with brushes, which act upon the internal surfaces of the casing; and, by their revolution, keep a current of air moving round, between the stone and the casing, by which means the apparatus and the meal are kept cool, and the meal prevented from any adhesion, thus securing it against all harm which might be caused if it were not kept clean. The brushes, acting as lifters, also raise the meal as it is formed to the elevated spout (F), which is high enough to deliver into a sack, bin, or flour dresser, or any other receptacle on the floor of a mill. By

this delivery and arrangement, one man is saved from what is usually needed with scuttle delivery. This patent mill ("Stamford," No. 3) is a 30-inch mill, fitted with either English or French burrstones, is mounted on a strong massive frame, and may be driven by an engine from four to six nominal horse-power—the latter being recommended where the full capacity of the mill is required. The stones are adjusted by means of a screw and lock nut, according to the work to be done; they are suited for any kind of work, from splitting beans to grinding, if needed, the finest meal. We were told by the inventors, that they have arranged a simple and cheap flour-dresser to form a part of the mill, the patent brushes to be utilised as those in an ordinary centrifugal machine, in order to force the fine meal through the gauge, and when the meal is required to be thus dressed, this mill can be worked in conjunction with an ordinary centrifugal flour-dresser which is attached to it.

Messrs. W. A. Wilcox and Co., No. 850, Flexible Suction Hose.—This hose is made quite differently from any previously introduced. The principle is as follows:—the internal part is a galvanized spiral wire, bound round with a strong substance similar to oilskin, and bound on the outside with a spiral wire, and so arranged that the outside wire binds the inside one and keeps it in its place, and prevents the kinking which is usual in the ordinary hose; and, being bound on the outside, the wear and tear which the hose is subject to by being dragged along the ground is prevented.

It is very suitable for agricultural engines, water barrels, and lifting hose for traction engines, each end being bound round strongly with wire, thus preventing the hose giving out at these places, so general with ordinary hose. This hose being made of an oily substance does not become injured by coming in contact with any oil, grease, &c.; whereas ordinary rubber hose, by any such contact, is caused to perish. No doubt, a hose thus constructed is an immense improvement upon the ordinary rubber hose. The price is from $10\frac{1}{2}d.$ to $2s.\ 6d.$ per foot. At this stand also was exhibited, amongst many other articles, a patent tube vice, made in two sizes; one to take ordinary tubes $\frac{1}{4}$ to $1\frac{1}{4}$ in., and others $\frac{1}{4}$ to $2\frac{1}{4}$ in. The arrangement is very simple, being two jaws assisted by a spring; the teeth of the jaws are cut in opposite directions, so that directly the tube or bolt, or any similar article to be screwed or held for any purpose, is placed between the jaws it grips them immediately, and the more pressure put upon the article, the tighter the vice will hold it, while it is entirely free from jamming the article. It is very light and cheap, and very handy. The smallest size weighs only 3 lbs., or about one-fifth that of the ordinary tube vice.

Messrs. Harrison, McGregor, and Co., No. 64, Knife Sharpener. —The patent Grinder and Sharpener introduced by this firm is designed for dispensing with the use of the file for sharpening reaping and mowing knives, sections, and fingers, which by this machine is effected by the use of a small emery-wheel; it is also available for sharpening finger or finger-plates.

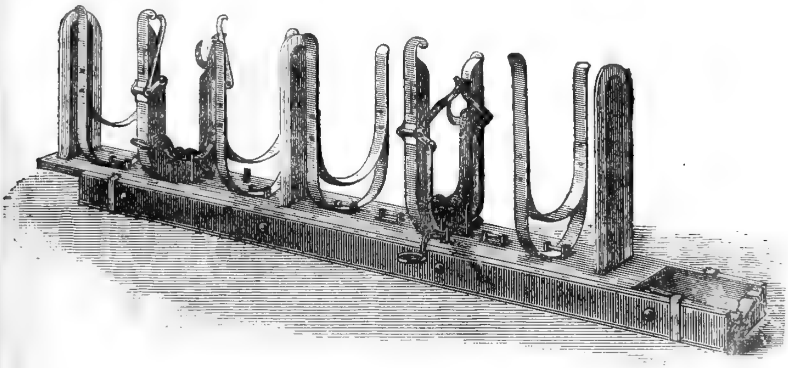
The frame of the machine consists of two parallel tubes secured to end plates, and mounted on angle-iron legs with stays carrying a fly-wheel and foot-treadle. On the parallel tubes is a sliding cross-piece, having a vertical swivel-fork, with a horizontal cross-shaft, carrying a grooved pulley and friction bevel-wheel, motion being communicated by a cord from the fly-wheel to the grooved pulley. On this same cross-shaft is hinged a moveable frame, which carries the grinding apparatus consisting of a spindle, having at one end a small emery-wheel, and at the other an india-rubber bevel-pinion which is driven by frictional contact with the bevel-wheel. By means of a handle attached to the moveable frame, the emery-wheel can be moved into any desired position, up or down, backwards or forwards, or sideways, the arrangement of sliding cross-piece, swivel-foot, and hinged moveable frame, admitting of a complete universal movement to the emery-wheel. When a knife is to be operated upon, it is secured on a rest at the forward end of the fixed frame, at right angles to the parallel tubes, and with its back to the operator.

A simple arrangement admits of shifting the knife endways, so as to bring any desired part into position to be operated upon; an adjustable pin maintains the grinding apparatus at the desired level to give the proper bevel to the cutting edge of the knife section, and an auxiliary lever is placed conveniently to the operator's left hand, to enable him to move the grinding apparatus easily backwards and forwards; while with the other handle he gives a gentle pressure sideways, so as to cause the emery-wheel to follow the angle of the section during the backward and forward movement. For grinding fingers, the finger-bar is secured so that the emery-wheel may be adjusted to come between the fingers and the desired level for giving the slight bevel required for the cutting edge of the finger-plates. The grinding apparatus is then moved backwards and forwards, either by means of the lever before mentioned, or simply by the handle on the moveable frame, the operator at the same time giving the necessary side pressure. For sharpening the points of the fingers, the level adjustment is removed; and the grinding-wheel is carried around the point of the finger in any desired position.

Mr. Thomas T. Mayo, No. 1814, Bolting Tier.—The machine

introduced by this exhibitor is for the purpose of trussing straw from the threshing-machine, and is composed of a sliding board, which works in a box or trough on rollers, allowing it to pass backward or forward as required. In this sliding board are fixed six receivers, held by a clip and bolt in the board, to receive the straw as it is threshed. The centre receiver of each three has a case of sheet-iron projecting from 5 to 6 inches, fixed to the frame of the receiver, inside of which are five sets of springs holding about two hundred strings, each string being capable of tying twenty-eight pounds of straw into a truss, or, if required, and lengthened, to tie up thirty-six. To each centre receiver is fixed two levers, which are brought together by a slot at the bottom, working through a treadle or lever, passing

Fig. 23.—*View of Mr. T. T. Mayo's Bolting Tier*, No. 1814.

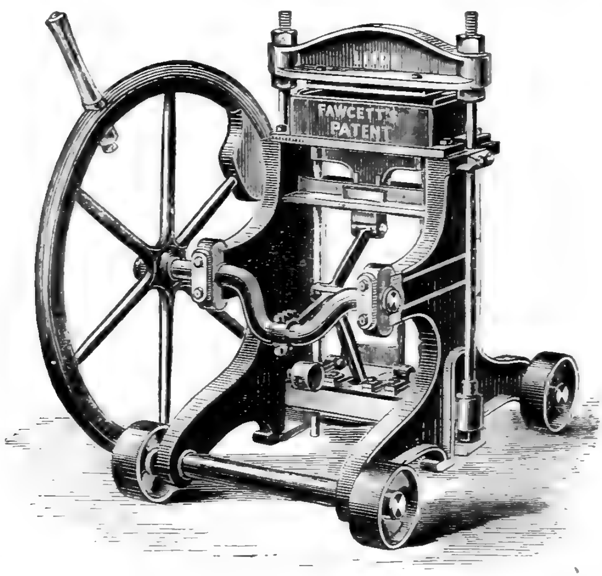


on into an upright guard, which has a spiral spring round it, that reverses the position of the lever after it has compressed the straw. Through the foot being placed on the treadle, a short lever is brought into action, which presses away the truss, so that the hand may pass without interruption to the strings in the receiver. The strings thus taken from both sides, you pass one loop through the other, which acts as a button, and is firmly tied. Remove the foot from the treadle, and the levers are thrown back, the short one acting as a guard for the strings in the receiver. This work may be accomplished by two strong lads. When the one set of receivers is full, one checks the straw on the straw-board, while the full one is passed from under, and the empty one takes its place, and so the work passes continuously. This machine has been allowed to be again exhibited as a "new implement."

Mr. Thomas Fawcett, No. 3760, Brick and Tile Press-Duplex

Lever.—The special feature of this machine is the simple and effective motion of pressure on the bricks; it is effected by two levers radiating to one centre (similar to the toggles of a stone-breaker), and worked by a small connecting-rod from a web crank with a fly-wheel and handle. The inventors claim that they get a leverage of five to one over presses which are worked by a simple crank, without increasing the stroke of the working crank. We found on personally working it that it bore out the representation made by the exhibitors. The levers and rods are of cast steel, and in their action they give a very

Fig. 24.—*Mr. T. Fawcett's Brick and Tile Press-Duplex Lever,* No. 3760.



powerful pressure, with little exertion from the crank. It is quick in its action, except when giving the final pressure; when pressed, the brick is lifted out of the mould automatically for taking away. This principle is probably an advantage over the ordinary lever for pressing bricks, and much more expeditious, and easy to work, owing to the absence of friction and the simple mode of giving the pressure.

Messrs. Burns, Taylor and Co., No. 566, Bean Splitter and Oat Crusher.—This mill is somewhat similar in appearance to the ordinary corn-crushers with two rollers. The chief novelty is the introduction of a knife-blade, placed longitudinally with and between the rollers, against the edge of which the beans

are driven and evenly cut by the contact; the two rollers are of equal diameter and length running parallel with each other; one of the rollers is carried on a weighted lever admitting of lateral play in case of any hard substance intervening, and so prevents any damage to the rollers. By simply removing the knife the mill is converted into an oat crusher. Another important feature is that it is fitted with a shaker feed, which prevents any possible choke to the rollers, since the speed of the rollers determines the quantity of feed. This introduction of the knife-blade certainly assists greatly the cutting or bruising of any soft corn. The crusher is strong in all its parts, but rather massive, which has tended to enhance its price, 17*l.* 10*s.*

Messrs. Marshall and Sons, No. 3909, Traction Engine.—On an eight-horse-power traction-engine Messrs. Marshall exhibited a pair of new patent spring driving-wheels. It is claimed for them that they are simple, efficient, and durable spring-wheels for traction and other purposes. The wheels are 6 feet in diameter by 16-inch face. The rim is made of 2 T-iron rings, 8 inches by 6 inches deep, to which catch steel brackets are riveted, the brackets having holes to take the pins which pass through the ends of the spokes; similar preparation is made in the boss of the wheel for taking the pins for the other end of the spokes. The spokes are curved, with an eye at each end.

The connection between the boss and the rim of the wheel is made by threading two spokes on one of the pins in the boss, the spokes being placed in opposite directions, and connected by means of pins through the eyes at the other end of the spokes to the brackets riveted to the rim of the wheel.

These spring-spokes merely carry the weight of the engine, the rim of the wheel being driven by two fixed arms connected to the rim by means of a drag-link.

The arrangement does away with all nuts, and offers every facility for taking out an old spoke and putting in a new one.

Messrs. Henry Bamford and Sons, No. 2949, Grinding Mill.—The most noticeable feature in this mill consists in its having reversible conical grinding plates, cut on both sides, so that when the pair of plates are worn out on one side they can be reversed. These plates appeared to be inexpensive, and on enquiry we were told that their price was 15*s.* per pair. The position of the grinding parts is arranged outside, so as to be got at without disturbing the shafts or bearings; the cover can be removed by slackening four bolts, and the plates then got at and reversed with the least trouble, and, fitting as they do into turned recesses, no packing is needed. After the corn is ground, the revolving disc elevates it to a spout, at the required

height for filling bags. By regulating one lever the vibration given to the feeding-trough is automatically varied. An advantage claimed for this mill is, that it can be run at different speeds, and effectually do its work—the speed recommended is 320 revolutions; but it will accomplish a corresponding amount of equal quality of work at 100 revolutions. The plates are made of cold-blast iron, and are exceedingly hard. Self-acting springs are attached to save injury from stones, nails, or any other hard substance passing through.

George Hathaway, No. 1086, Shakespearian Churn.—This churn is entirely without beaters or other internal arrangements, consequently simple and easy to clean.

The barrel is hung on the eccentric principle, with the idea of giving greater and continual concussion as the cream falls from end to end. The great novelty in the churn is the fitting with a circular hollow metal plate, which is attached to the bottom, forming a chamber to contain hot water (indispensable in cold weather); and as cream is required to be at a temperature of from 58 to 60 degrees, to be proper for churning, this arrangement entirely obviates other more troublesome processes, as the temperature of the contents of the churn can be raised in a short time by the use of hot water in this chamber. It is equally effective in hot weather by using cold water in the same manner.

The bung, which is the *whole* of one end of the churn, is made of one piece of mahogany, and is forced into a metallic ring of angular shape, and flanged over with pressure without a screw or rivet, giving a very smooth surface, simple and easy to clean. This arrangement supersedes the original bung, which was heavy and complicated.

Mr. Robert Maynard, No. 3304, Chaff-Cutter.—This machine, named the "Mighty," is fitted with seven knives, and is on a similar principle to the chaff-cutter made by the same inventors with six knives, complaint having been made that the latter was unequal to chaff fast enough to keep the thresher-shaker clear. The surface of the feed-rollers travels proportionately fast to make up for the other extra knife, so that the same sample is produced as in his other size; the feed-box and mouth are also made wider. From trials made with this machine we were told that it is capable of chaffing all the straw from any threshing-machine—and from its appearance we are inclined to endorse this statement. An ingenious arrangement is made to sharpen the knives without the trouble and time of taking them off, as is usually the case. For this purpose a plate is attached, on which are screwed a series of wide files about six inches long, making a plate of files. By means of

a small lever on the outside of the casing round the knife-wheel, the said plate of files is pressed up to the back of the knife on to the cutting edge; these files on the back of the knife, which we doubted being capable to produce an edge, on trial really did produce a keen edge as if filed up by hand, and laid as well on the steel mouth. To accomplish this sharpening the machine had to be driven somewhat slower for a few revolutions. The cutter also is fitted with a new patent automaton feeder, which dispenses with manual labour, the danger of which is somewhat great. The price of this chaff-cutter is 69*l.*

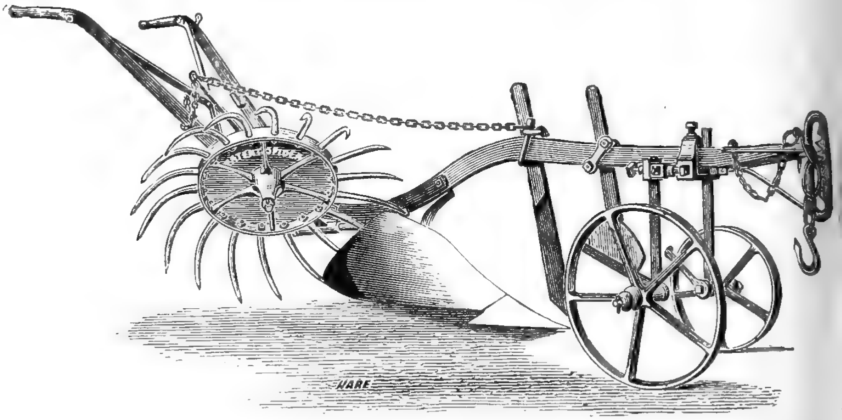
Mr. William Bone, No. 574, Grain Separator.—The speciality of this machine consists chiefly of an inclined flat surface, called the separating surface, covered with cells, having a double motion imparted to it by means of a very simple but ingenious mechanism.

The flat moving surface above mentioned is composed of narrow strips of wood, indented with cells on the upper surface, each one being covered with zinc to increase its durability; the cells, when clear, are sufficiently large to contain cockle seed, hariff, broken barley, or any other substance smaller than the grain, but not large enough to hold any perfect grains. The strips are attached to an endless band, moving on pulleys, thus giving to the separator's inclined surface a constant motion in one direction from its lower to its upper end. The other motion imparted to the separating surface is of a reciprocating and sifting character. The grain to be cleaned is delivered from the hopper on to the upper end of the separating surface, which, being inclined, and having a sifting motion, causes the grain to work down over its cellular surface to a spout at its lower end. The grain in thus passing over the separating surface leaves the seeds, broken grains, &c., behind, having fallen into the cells already referred to. The upward motion of the cellular surface carries the refuse with it, and delivers it at the end of the machine farthest from the clean corn.

Messrs. Murton and Turner, No. 2612, Spider.—This article attached to a plough was rather novel; but the makers assured us that in practice it fully bore out their representation. Without the opportunity of a trial, we accepted their remarks, and received the following particulars respecting the implement. The "Spider Plough," is a piece of mechanism which, attached to the right or furrow side of the plough, performs the operation of harrowing the turned-up soil, and of throwing all the grass and weeds on to the surface, which is at the same time levelled, thus saving the labour of horses and harrowing. The inventor of this implement is Mr. C. Barker, agent to Sir R. Buxton, Bart., and it is in constant use upon the home farm, while

many are in use in that neighbourhood. It consists primarily of two circular flattened rims, two feet in diameter, between which any number of teeth can be inserted at intervals, and held firmly by screws and nuts; these rims are supported upon eight spokes fixed in a hob which works on an iron axle with a five-inch bearing. The long teeth fixed in the rims curve outwardly about five inches, and thus the implement gives somewhat the appearance of its name; the axle of the "spider" is inserted in a patent slotted lever, which is fastened to and adjustable upon an iron rod fixed behind the body of the plough. At the other end of the lever, which is about 3 ft. 3 in. long, is a hole through which runs a chain, one of which is fixed to the beam, and the other to the tail of the plough; when fixed, the "spider" hangs at an angle of 35 degrees on the furrow side.

Fig. 25.—*Messrs. Murton and Turner's "Spider Plough,"* No. 2612.



By means of a slot into which the lever is fixed into the iron rod, the implement can be adjusted to the work; no other motive power is required than that necessary for the plough. By the motion of the plough the "spider" is made to revolve by the obstruction of the clods, which it catches in its teeth and breaks up, and exposes the roots of grass on the surface. It may be a useful attachment to a plough on light soils. I should somewhat doubt its efficacy on strong land.

Messrs. Thomas Corbett, No. 1607, Chaff Cutter and Elevator. —This combined chaff and ensilage cutter and elevator consists of one of Mr. Corbett's "Dirri" chaff cutters on wooden frames, the fly-wheel having three knives, the gear-wheels being entirely of new design; the cheek and mouthpiece of the machine are supported on a strong girder of wrought iron placed on

edge, by which arrangement great strength is imparted and the mouthpiece shortened; when at work it is quite rigid, all vibration (so detrimental to such machines) being overcome; in the bottom and outside of the mouthpiece, steel plates are fixed, which render the machine self-sharpening. The fly-wheel of the machine and the revolving fan are enclosed in a circular case, in connection with which a trunk or conductor is applied, which can be made at any required angle, so as to deliver the cut material into a sack, cart, or silo, as may be desired. On the fly-wheel shaft, and working loose thereon, a casting is applied, with fan arms carrying blades or spoons, which by a series of pulleys or wheels is made to revolve in an opposite direction to the fly-wheel, and at a sufficiently high speed to create a strong blast; and, as the material is cut, lifts and delivers it through the trunk or conductor to a distance of 30 to 40 feet.

A patent safety bar is arranged so that the pressure of a man's body instantly throws the machine out of gear, and debars any accident.

Messrs. Crossley Brothers, No. 3159, Gas-making Apparatus. —This gas-making apparatus, manufactured and patented by Mr. Henry Rogers, Watford, is for the manufacture of illuminating and heating gas from hydrocarbon oils.

The plant is extremely simple and neat in its appearance; and on this occasion, gas was being generated for six of the "Otto" gas-engines from a single retort and small gas-holder, about 6 feet in diameter.

Gas-engines worked by this gas are said to be extremely economical, less than half the usual amount of gas being asserted to be used per H.P. per hour, while the cylinder and valves are not found to clog in the slightest degree. One great feature of the "Watford" gas appears to be its brilliancy and economy for illuminating purposes; it is quite free from sulphur, and is therefore an absolutely pure gas, the cost being (as compared with London coal gas) about 1*s.* 9*d.* per 1000 cubic feet. It is thus apparent that a country gentleman can at a small expense have his mansion lighted, his engine worked, and his cooking done by one and the same gas generator. About 50 of these works, Mr. Rogers informed us, are in operation, and are giving general satisfaction; the cost of erection being about one-third that of a coal-gas plant.

Ofverum Estates Co., No. 2727, Chaff Cutter, Spangberg's Patent.—This chaff-cutter is entirely without cog-wheels, or feed rollers, and its construction is such that there is no loss of power by friction. The feeding is effected by a sliding traverse, to and fro, of the whole box, so giving a length of cut,

varying from ½ an inch to 8 inches, which is governed by fixing the crank pin at different distances from the centre of the crank disc, so that the stroke of the box varies according to the desired cut. The pin having its place in a groove in the disc, the required lengths can be easily obtained by loosening the nut that holds the pin. To adjust the knife, screws are placed in the fly-wheel arm, where the knife is fastened. For cutting straw for litter this machine was very effective, notwithstanding the simplicity of its construction and its cheapness. There is no question that economy of straw will have to be studied by farmers, as well as by all stockowners, more than it has hitherto been; and I consider that as a machine calculated to cut straw for litter this exhibit was excellent, the extreme simplicity and easy working of it, together with its price, rendering it worthy of special notice. Price 5*l.* 17*s.* 6*d.* This machine will be allowed to be exhibited again as a "new implement."

Messrs. Samuelson and Co., No. 2835, Roller Mill.—This is a four roller mill, which can be used either with fluted rolls, for the reduction of wheat, or smooth rolls, for reducing middlings. The points of excellence claimed for this mill, which is most adapted to a miller, are that it is of sufficient weight to ensure its running steadily, that the frame work is rigidly put together, and the rolls encased, that they can be easily taken out for regrooving or regrinding, without taking the whole mill in pieces; the bearings being exceptionally long, and that the steel spindles, of larger diameter than usual, give increased durability. The adjustment of the moveable rollers is such that the rolls can be brought to their working position, or drawn apart, without affecting the pressure upon the relief spring. Price 130*l.*

Messrs. Fowler and Co., No. 3095, Five-Furrow Balance Plough.—Messrs. Fowler and Co. have introduced into their Five-Furrow Patent Balance Plough what they term an anti-balance gear, by the action of which all tendency of the plough to jump out of its work is overcome, and a level sole is produced, which is of great importance.

The arrangement may be described as follows. When the plough is on the balance, the axle with the travelling-wheels is situated on the centre line of the plough.

Instead, however, of the axle being fixed in this position, and the plough balancing upon it, the axle is fitted with two pinions, which travel in a rack path extending some distance to either side of the centre line of the plough, the path inclining from the centre line at the same angle as the opposite portion of the plough. On the centre of the axle is a chain wheel, round which the hauling ropes pass, any strain on which tends to make the axles revolve, and thus travel in one or other

direction along the rack. Assuming the plough to be on the balance (that is, with the axle corresponding to the centre line of the plough), any strain on the hauling rope makes the pinions of the axle travel towards the forward end of the plough; and the cam path being parallel with the working end of the plough, the front portion of the plough is lifted up and the balance overcome. Pulling in the opposite direction just reverses the operation. The arrangement is simple, and commends itself as a decided improvement.

Messrs. Hayes and Sons, No. 435, Dog Cart.—We could not help being tempted into an inspection of the Stand of Hayes and Sons, Coach Builders, and our attention was centred upon their "Rutland Dog Cart," with its perfect balancing and brake arrangements. The usual custom and acknowledged annoyance, of having the seats fixed with pins in holes, is in this cart overcome by an arrangement whereby the hind and front seats are secured together, and which can be slided backward or forward as may be required, either to accommodate the number of passengers or the gradients of the road; the driver can release a spring attached to the driving seat, which at once allows the seats to be slided backwards or forwards.

Mr. C. G. Roberts, Haslemere, Surrey, Articles 2088 and 2089.—These Separators, the first (2088) is a simple Separator for rain-water for roofs of from 1200 to 1800 ft. area, arranged to act slowly in moderate rain and quicker showers, the time being regulated by adjustable gauges to give a wash of from 1 to 2 galls. per 100 ft. super of roof.

The other (2089) is a compound horizontal Separator for rain-water, specially designed where economy of water is necessary, and arranged with syphon action, so as to remain canted for five hours after the rain ceases, is an improvement upon the separators which have from time to time been exhibited by Mr. Roberts, and which were illustrated in the Report upon the Miscellaneous Implements at Reading (vol. xviii. Pt. 2), 1882, and the following year were subjected to a series of trials by Mr. Copperthwaite, Engineer to the North-Eastern Railway at York, and also by Mr. Coleman at Escrick, reported in the Society's 'Journal' for that year (vol. xix. Pt. 2).

The results of these experiments showed that there was a considerable waste of water in the working of the apparatus. To overcome this, in the present machines, great ingenuity has been displayed, and so far as can be judged from a cursory examination, apparently with success. Without a prolonged trial—which it would be desirable to institute—a definite opinion cannot be formed.

A most interesting feature in connection with the meeting of

the Society being held at Norwich was at the stand of Messrs. Ransome, namely, a large gold ploughshare, surrounded with varieties of the chilled ploughshares which they have made for so many years. This patent chilled share was invented by Robert Ransome, the founder of the firm, in the year 1803. Mr. Ransome had long paid his attention to the improvement of the ploughshare, and when at his small foundry at Norwich, in 1785, he took out his first patent for tempering the common cast-iron ploughshare, which at that time was made of the ordinary metal, and of the same hardness throughout.

Mr. Ransome's object was to harden the edge of the cast-iron ploughshare, so that it would last much longer. This first improvement was obtained by saturating with salt-water those portions of the mould which came into contact with the cutting-edge of the share, so that the iron, coming into contact with these, might be hardened. This improvement was brought to a climax in 1803 by his invention of casting the hot metal on *iron*, instead of on sand-moulds, which crystallized the under-surface of the share, rendering it harder than steel, at the same time leaving the upper part soft, so that in wear it would maintain its sharp cutting-edge. This process, invented by Mr. Ransome 82 years ago, has been in constant use ever since, not only by the Ransomes, but by all makers of chilled ploughshares, and many millions of shares have been sold,—I dare not say how many millions of acres have been ploughed since that day with these patent shares.

The saving to the agricultural community has been very great, as the price of the shares is not only much less than that of the wrought-iron shares which they superseded, but as the great loss of time which was formerly caused every day by doing-up these wrought-iron shares at the blacksmiths has been avoided.

Chilled-iron has been put to a great many uses; for making chilled-shot, chilled railway-crossings, chilled-bearings, and many other purposes, but none have such interest to farmers than this very application to plough-shares; and Mr. Ransome's early connection with Norwich, upwards of 100 years ago, made this a very appropriate exhibition at this Meeting.

In conclusion, I beg, on behalf of myself and my fellow Judges, to express our best thanks to Mr. F. S. Courtney for his valuable assistance given us in mechanical questions; and especially to the Stewards, Sir John Thorold, Mr. Little, and Mr. Hemsley, who were most attentive, and so readily rendered every assistance towards facilitating our work.

XXI.—*Note on the Farm-Prize Competition of* 1885.

Lord Sefton having taken exception, as against a portion of the Preston Farm Judges' Report of 1885 [Journal of the Royal Agricultural Society of England, vol. xxi. p. 580], the Journal Committee, under date April 8, 1886, addressed his Lordship as follows:—

"*The Secretary to the Earl of Sefton, K.G.*

"I am instructed by the Journal Committee to express to your Lordship their great regret that the Report of the Judges at the last Farm-prize Competition has appeared unsatisfactory to you, as, in your opinion, it seemed to reflect upon the relationship which exists between your tenantry and yourself. With a view to avoid any such difficulty in future the Committee will carefully reconsider the instructions which they issue to the Judges of Farms; but as matters stand at present the Judges are desired to verify the statements that they may receive from the competitors. With regard to the Preston Competition, the Committee desire me to say that they will be happy to submit to the favourable consideration of the Council any correction of matters of fact which you may desire to send to me; but it is impossible to open the pages of the Society's 'Journal' to controversy."

The following *ex parte* statement is published accordingly:—

"In the Report upon this farm, of which Lord Sefton is the landlord, it is stated that the agreement is 'tight.' It implies that, previous to the Act of 1883, the tenant had no security for permanent improvements—that the rent appeared to have been raised since 1866 at different times, and that an increase of 98*l.* 10*s.* 0*d.* was made for an outlay of about 2000*l.* and for an addition of 8 acres of land hardly worth having.

"The 'Facts' are: that the agreement gives perfect freedom of cultivation, unrestricted sale of produce, and twelve months' notice. Further, it was drawn up with the *express* view of securing the tenants' compensation in conformity with the spirit of the Act of 1875, though it contracts out of the Act.

"If the tenants *now* depend on the Act of 1883, it is not because they had no security before, but because the Act of 1883 overrides any agreement between landlords and tenants.

"The agreement was framed, not by Lord Sefton or his agent alone, but five tenant farmers were taken into consultation, who discussed and approved of every clause, before it was issued for use on the estate.

"Mark Wright has been on the Gill Moss farm for 30 years, and the rent of the farm, with the house and buildings and two cottages, originally let to him, has never been raised.

"Once the rent has been *increased* as stated, 98*l.* 10*s.* 0*d.*, that is 56*l.* as mutually agreed upon for an entirely new set of farm buildings, and a new house, which cost 2400*l.*; and 42*l.* 10*s.* 0*d.* for 15a. 1r. 3p. (not 8 acres) of land added—out of condition, but for which the previous tenant had paid 70*s.* per statute acre.

"The tenant also took two more cottages, at a rent of 2*s.* per week, shortly afterwards.

"The rent for the farm, with 4 cottages included, is 452*l.* 18*s.* 0*d.* per annum, so that when the value of the cottages is deducted it is under 2*l.* per statute acre. It lies within 5 miles of Liverpool; and the tenant enjoys certain advantages, as his landlord keeps an occupation road and some 2 miles of fences in repair."

XXII.—*Report on the Farm-Prize Competition in Norfolk and Suffolk in* 1886. By W. J. Moscrop, Loftus, Saltburn-by-the-Sea, Yorkshire.

Judges.

William Jonas, Heydon Bury, Royston.
George Rutherford, Printonan, Coldstream, N.B.
William J. Moscrop, Loftus, Saltburn-by-the-Sea.

The fourteen farms entered in the competition for the prizes offered by the Norwich Local Committee, through the Royal Agricultural Society, in connection with its annual exhibition, held this year at Norwich, are situated, as regards nine of them, in the county of Norfolk, while the other five are in Suffolk.

Hitherto it has been the practice of those reporting on the competing farms to briefly touch on the geographical, geological, statistical, and other prominent features incidental to the district in which the Show for the year is held, more especially those having a direct bearing on its Agriculture. Believing that such features as the counties now in reference present will be found fraught with matter more than ordinarily interesting to readers of the 'Journal,' I will make no apology for embodying them in this paper.

Physical Features and Agriculture of Norfolk.

Norfolk is a maritime county in the east of England; it is bounded on the N.W. by the Wash; on the N. and N.E. by the North Sea; on the S.E. by the Breydon Water and River Waveney; on the S. by the Waveney, a short artificial line, and the Little Ouse; on the S.W. and W. by the New and Old Welney, and again a short artificial line. It is joined on the W. by Lincolnshire; on the S.W. by Cambridgeshire; on the S. and S.E. by Suffolk. It is so nearly surrounded by water as to be almost an island, nearly two-thirds of its boundaries being tidal water. The coast has an aggregate length of nearly 100 miles; it has no bays, creeks, or headlands of any note; it is everywhere monotonous and tame, and lies so flat and low as to be visible at but a very short distance at sea. The general surface of the county is flatter, lower, and less diversified in feature than any other tract of land of equal extent in the kingdom; it boasts neither of hills nor mountains, and is best and simplest described as a "great plain."

The principal rivers are the Ouse in the west, which is tidal to Denver, with its tributaries, the Little Ouse, the Wisney, and the War; the Yare in the east, which is navigable for small vessels

as far as Norwich, with its tributaries the Bure, navigable to Aylsham, the Wensum and the Waveney, navigable to Beccles.

Nearly the whole of the county is occupied by the Chalk formation, but, on account of the overlying drift deposits, it forms a comparatively small proportion of the surface. The chalk is of three varieties; (1) chalk marl; (2) lower or hard chalk, sometimes so hard and compact as to be suitable for building purposes, and therefore utilised in West Norfolk for the construction of cottages; (3) upper chalk, interspersed with black flints, which are also used for building purposes, this last variety constituting the greater bulk of the formation. Gault, Upper Greensand, and Lower Greensand crop out from beneath the chalk in the west of the county, and are followed by Kimmeridge Clay. To the west of this, along the border of Cambridgeshire, there is a stretch of Fen land (Drift or Post Tertiary) extending to the Wash. In the east of the county is a long, narrow, irregular belt of the Crag formation, extending almost from the north coast to the boundary with Suffolk. The Greensand is commonly of a dingy brown or whitish colour. Marl occurs in the valley of the River Bure; it is this substance which has been one of the great factors in the remarkable improvement which took place in the agriculture of the county upwards of a century ago.

Norfolk contains a greater variety of soils than any other county in England; the greater portion is naturally light and poor, but much has been brought to a state of great fertility. Speaking generally, it may be said that the soils in the north and west are chalky; in the south-east they are of a light sandy nature, varying from a blowing sand to a soil of average fertility; in the middle and east the soils are mostly of a loamy nature, but of very variable qualities, generally light and workable, but sometimes consisting of stiff boulder clay. On the borders of Lincolnshire and Cambridgeshire, and along the valleys of the rivers, they are generally alluvial clays and loams. The Marsh lands on the east coast are usually flooded in winter, but at other seasons of the year afford capital pasturage for stock.

On account of the exposed situations of the coast, the north and north-east winds affect Norfolk more than any other county in the kingdom; the climate consequently is much colder, and vegetation in the early spring is more tardy than in adjoining counties. The atmosphere, however, is in general dry and healthy, and free from fogs, except in the marshy districts. The average rainfall for fifteen years, from 1866–80, was only 26·68 inches, as compared with 44 inches, which was the mean fall during the same period in Lancashire, the county visited by the Society last year. This circumstance greatly

influences the cropping, and accounts for the limited acreage under permanent grass, which the Agricultural Statistics show.

Norfolk is only exceeded in area by three English counties, viz., Yorkshire, Lincolnshire, and Devonshire. The gross area is—land and water—1,356,173 acres, of which 1,090,967 acres, or nearly 80 per cent. of the total area, are returned as being actually utilised for agricultural purposes.

The Tables hereunder given show how this area was cropped in the years 1884 and 1885, and may be taken as a fair epitome of the annual croppage of the county.

		1884.	1885.
Total Area under Cultivation		1,090,725	1,090,967
Corn Crops	Wheat	181,927	162,661
	Barley	193,166	208,475
	Oats	31,842	34,849
	Rye	5,508	6,533
		412,443	412,518
Green Crops	Potatoes	5,837	5,984
	Turnips and Swedes	136,316	130,910
	Mangolds	46,787	51,055
	Carrots	497	737
	Cabbage, Rape, &c.	3,000	3.486
	Vetches, &c.	13,247	15,123
	Beans and Peas	25,050	25,734
	Rotation Grasses	163,012	162,703
	Bare Fallow	13,726	10,977
		407,472	406,709
Permanent Pasture		270,793	271,717

If we deduct the amount of permanent pasture from the total area under cultivation, we find that the remainder—the total area of arable land—is divided almost equally between corn and green crops, thus proving that the greater portion of the county is still under the four-course rotation. Wheat and barley together occupy 85 per cent. of the total area under corn crops; whilst the acreage under oats is, as might be expected from the extreme dryness of the climate, very limited, not being more than 8 per cent. of that under corn crops. It will be seen that barley is grown to a greater extent than any other crop in the county. Norfolk has long been celebrated for the production of barley of an extra good quality, which is in great request for malting. Wheat of extra quality is also grown.

These figures further show that the quantity of potatoes grown is very small, and we may also note that only one-fourth of the whole cultivated area consists of permanent grass.

I now turn to the Live-stock Statistics.

Horses.—Used solely for agricultural purposes	43,722
„ Unbroken horses and brood mares	19,185
	62,907

This shows that there is about one pair of working horses to every 37 acres of arable land. The number of young horses and brood mares in the county is very large, being only exceeded by the numbers returned from Yorkshire and Devonshire, and being 6 per cent. of the total number returned for the whole of England.

Cattle.—Cows and heifers in calf or milk	32,733
„ Other cattle	89,822
	122,555

Cattle bred in the county during one year		10,458
„ died from disease or accident	2,413	
„ slaughtered for meat on holdings ..	7,102	
		9,515
		943

The number of cattle shown by these Returns is small as compared with that returned from other counties; but they do not give even an approximate idea of what are maintained in the county for half the year at least. Owing chiefly to the small acreage of grass, few cattle are kept during the summer months, and when the Returns are collected, the county may be said to be almost denuded of them; but large numbers are bought in the autumn to consume the straw and root-crops during the winter. If the Returns were made in January, instead of June, a very different complexion would be put on the matter; and it probably would be found that besides being one of the largest corn-growing districts in the kingdom, Norfolk is also one of its greatest beef-producers. If the Returns made in 1885 may be taken as those of an average year, it would appear that the number of cattle bred in Norfolk does very little more than balance the deficiency caused by death and by animals slaughtered on the holdings. It would be interesting if we could by any means arrive at the number of store cattle annually brought into Norfolk from other parts of the kingdom.

Sheep.—One year old and above		329,284
„ Under 1 year old		260,099
		589,383
Sheep bred in the county during one year		73,447
„ died from disease or accident	10,765	
„ slaughtered for meat on holdings ..	24,634	
		35,399
		38,046

We see here again, that the greater part of the sheep stock is bought. An examination of the above figures shows that at least 200,000 sheep must be purchased annually in order to keep up the total number returned.

The number of pigs returned was 95,597, of which 51,063 are annually bred in the county. In 1884 there were 114,364 pigs; thus there was a decrease of nearly 20,000, or 25 per cent. in twelve months!

There are 72 silos in Norfolk, with a total capacity of 174,282 cubic feet, and an average capacity of 2421 cubic feet. They should contain about 3485 tons of silage, an average of about 48 tons each.

According to the latest figures, the total number of landed proprietors in Norfolk is 26,648, possessing 1,234,884 acres, yielding an annual rental of 2,403,795*l.* Of these, 16,552, or 62 per cent., possess less than an acre.

H.R.H. the Prince of Wales, to whom the members of the Royal Agricultural Society owe so much in many ways, has been a landowner and farmer in the county since 1863. His Sandringham estate is 8000 acres in extent, of which he farms 1000 acres. On this farm is kept a large number of Shorthorns, but in two distinct herds; one being of the Bates strain of blood, while Booth blood predominates in the other. A Southdown flock of sheep of great purity and character, and now of notoriety in the Showyard, also forms part of its live-stock.

We have it on undoubted authority that on no estate in Norfolk is the motto that "Property has its duties as well as its rights" more loyally or practically construed than at Sandringham. And further, that no landowner possessing an estate of such magnitude within the county, takes greater interest in its economy, or is more conversant with every detail incident to its management, than is His Royal Highness.

Whether at the present time the farming of Norfolk is at all in advance of other districts that could be named, we prefer to leave an open question. A well-known authority thus solves this question. "If Norfolk no longer occupies its leading

position—Agricultural—it is not because it has dropped behind, but because other counties have pushed forward, and the course of events are tending to equalise the arts of cultivation throughout the kingdom."

There cannot, however, be much doubt that during the last century and the beginning of the present, her agriculturists have been the pioneers in adopting principles and practices, sound and profitable, which, spreading to other localities, tended greatly to the material progress and improvement of the art throughout the kingdom. I may instance the introduction of the turnip as a field crop early in the last century, by Lord Townshend at Rainham, the importance of which step may be best measured by imagining what this country at the present day would be without turnips. The wits of the day dubbed his Lordship "Turnip Townshend," a sobriquet he had little cause to feel aggrieved at. Later on he was referred to by a local poet—

> "Thus Townshend gave the master key
> T' unlock the stores of husbandry;
> Who, like Triptolemus of old,
> From clods made rustics gather gold:
> Friend patriarchal to our county,
> Still as we taste, we own thy bounty."

In 1789 the Swedish turnip was first grown in the county by Dr. Miles Beevor, of Mulbarton House, he having received the seed through the Swedish Ambassador. About the same date the corn drill was introduced, and we find that by 1804 its use was pretty universal. A rational rotation of cropping, known as the "Norfolk System of Husbandry," was practised early in the eighteenth century. On this, Arthur Young in 1804, wrote:—

"If I were to be called on to name one peculiar circumstance which has done more honour to the husbandry of Norfolk than any other to be thought of, I should, without hesitation, instance the rotation of cropping. I should not hazard perhaps too bold an assertion were I to declare that, till the accession of his present Majesty, there were to be found few just ideas on this subject in the works on husbandry of any author preceding that period; if anything tolerable occurs, it is mixed with so much that is erroneous that credit cannot be given even for what is good. The fields of the rest of the kingdom presented a similar exhibition: right courses hardly anywhere, perhaps nowhere, to be found. But, in West Norfolk, the predominant principle which governed their husbandry at that period, as well as ever since, was the careful avoiding two white corn crops in succession. Turnips were made the preparation for barley, and grasses for wheat."

Young in respect to the Husbandry further wrote, thus:—

"The farming mind in this county has undergone two pretty considerable revolutions. For thirty years, from 1730 to 1760, the great improvements in the north-western part of the county took place, which rendered the county in general famous. For the next thirty years, to about 1790, I think they

stood still; *they reposed upon their laurels.* About that period a second revolution was working; they seemed then to awaken to new ideas; an experimental spirit began to spread, much owing, it is said, to the introduction of drilling, and so a new practice set men to thinking, it is not unlikely; nothing can be done until men think, and they had not thought for thirty years preceding. About that time also, Mr. Coke (who has done more for the husbandry of this county than any man since the turnip Lord Townshend) began his Sheep-Shearing Meetings. These causes combined to raise a spirit which has not subsided."

The improvement which he refers to in the north-western part of the county was the application of marl and clay to the light sand and gravel soils, which effected the conversion of warrens and sheep-walks into some of the finest corn districts in the kingdom. From 40 to 180 loads per acre was applied, the average cost being about 50*s.* per acre.

This was also extensively done at Holkham, by Mr. Coke, in the improvements of his estates there—a lucid account of which will be found in vol. iii. of the First Series of this 'Journal.'

Young also mentions "that Mr. Coke spent 100,000*l.* in farm-houses and offices," but he finishes his description of the buildings as follows. "I wish I had it in my power to add that I saw a good farmyard in the county, manifesting contrivance, and in which no building could be moved to any other '*Scite*,' without doing mischief. Where is such to be found?" I fear the responses *here*, would not take much counting if the same question were to be asked at the present day.

Since Young reported, I am inclined to think that, taking the county generally, it has pretty well held its own. In arable cultivation the excellent crops of roots and corn produced on soils naturally inferior is something remarkable, which probably in a great measure results from the large quantity of linseed- and cotton-cakes which are so generally used. A cake of 8 lbs. per day is in most counties considered a liberal allowance to a fatting bullock; but on several of the farms we went over such is considered a minimum quantity, and from that to 14 lbs. is not unusual. Sheep get 1 lb. each per day.

In the matter of live-stock, too, there has been a very marked advance. Young says of the breed of his day: "Cattle in Norfolk do not offer much that is interesting; they have a breed of their own, which possesses no qualities sufficient to make it an object of particular attention. I viewed a dairy at Milcham, the only one left in that country of the true old Norfolk breed of cows. Middle horned, some rather shorter; colour red, some not unlike the Devon; as loose and ill-made as bad Suffolks."

Singularly enough, we find the same colour prevalent in the

horned breed then existent as in the Polls of the present time. It is supposed that the Red Polled breed was in existence in Norfolk at the time he wrote; but their number must have been very limited to escape the notice of so close and diligent an observer. The breed, however, was then a noted one in Suffolk, and celebrated for the great quantity of milk which the cows gave.

Young's description of the heavy milkers of the breed is: "A clean throat with little dewlap; a thin clean snake head; thin legs; a very large carcass; rib tolerably springing from centre of the back, but with a heavy belly; back bone ridged; chine thin and hollow; loin narrow; udder large, loose, and creased when empty; milk veins remarkably large, and rising in knotted puffs to the eye. A general habit of leanness, hip bones high, and ill-covered, and scarcely any part of the carcass so formed and covered as to please an eye accustomed to fat beasts of the finer breeds." This was no doubt an accurate description.

The breed which largely prevails now both in Norfolk and Suffolk is a continuation of the above, greatly improved in contour and the essential points which constitute a good butcher's beast, without, it is believed, any diminution of its original milking capabilities. The number and excellence of the breed shown at Norwich this year constituted one of the chief features of the Show.

A Herd-book for the registration of animals of the breed was established in 1874, the Standard description having been previously agreed upon by the breeders, which is as follows:—

"*Colour.*—Red. The tip of the tail and the udder may be white. The extension of the white of the udder a few inches along the inside of the flank, or a small white spot, or mark on the under part of the belly by the milk veins, shall not disqualify an animal whose sire and dam form part of an established herd of the breed, or answer all other essentials of the 'Standard description.'

"*Form.*—There shall be no horns, slugs, or abortive horns.

Points of a Superior Animal.

"*Colour.*—A deep red, with udder of same colour, but tip of tail may be white. Nose not dark or cloudy.

"*Form.*—A neat head and throat, a full eye. A tuft or crest of hair should hang over forehead. The frontal bones should begin to contract a little above the eye, and terminate in a narrow prominence at summit of head.

"In all other particulars the commonly accepted points of a superior animal are taken as applying to Red Polled Cattle."

In Young's time, 50 stones seemed to be about the standard weight they attained to, but he does not say at what age. It is believed that the breed is now of a size capable of attaining to greater weights, without any deterioration of quality of flesh

having taken place, which is claimed to be equal to the best Polled Scot or Highlander. "The percentage of dead-weight to live has ranged from 65 to 66·75 for all animals of the Red Polled breed whose dead-weight has been compared with live-weight."

Mr. Euren, the able and courteous editor of the 'Red Polled Herdbook,' kindly supplies the following: "There is evidence that Red Polled cattle were all along the district of South Norfolk and North Suffolk from a very early period. The theory started by Youatt that they were descended from Galloways has no evidence whatever to support it. The probability rather is that the cattle were here from the times of the Danish settlement, that both the cattle and trotting horses were here from the times of the early Norse settlement. This view is corroborated by the fact that similar cattle have been known in Hungary from time immemorial, and these we may suppose to be descended from the Polled cattle which Herodotus mentions as having been owned by the Scythians." Whether the breed is fairly entitled to the claim of antiquity thus put forward is a matter of less consequence than the acknowledged utility it now possesses, alike for the grazier and the dairy-farmer, and the two counties are to be congratulated on the conservation and improvement of so valuable a tribe of animals.

In the breed of sheep within the present century there have been greater changes and improvements even than in cattle. In Arthur Young's time, the breed prevalent in Norfolk and Suffolk was a black-faced horned sheep, which he mentions as having existed there for ages, and of which the farmers were extremely proud. His description of them is as follows: "They are horned; bear clothing-wool, the third in the kingdom for fineness; fleece about 2 lbs. Shape bad, loins narrow, back-bone high, chines thin, legs long, pelt good, disposition very wild and roving, not hardy, though formerly thought so; rate of stocking, half a sheep per acre. Mutton, 18 lbs. per quarter, equal to any in the world in cold weather, and yields an uncommon quantity of high-coloured gravy." Southdowns began to be introduced about that time, and have ever since held their ground—several of the crack show flocks of the country being located in Norfolk, witness Lord Walsingham's, Mr. Colman's, the Prince of Wales's, and others—and the result of crossing the old Norfolk sheep with them was the creation of a new breed possessing the good qualities of both, the lean meat of Norfolk with the better grazing propensities of the Southdown, and a sheep eminently adapted for the sands of East Anglia. The breed is now known as the Suffolk, and retains the characteristic black face and legs of the old Norfolk, but has got rid of the

horns. About the time of the late Mr. Dobito, who was greatly interested in sheep, the cross was first known as Suffolks; and from that period they have been acknowledged as a distinct breed, and are now kept in large numbers all over Suffolk and in several districts in Norfolk. A flock-book has been instituted for the registration of pedigrees, and there is every prospect of the breed maintaining the hold it has acquired in the counties, and may probably extend to others in turn. The mutton is reported to be worth fully 1*d.* per lb. more than that from the long-wool cross; and so famous has it become, that gentlemen of the Turf frequenting Newmarket and tasting it there, are having it sent to their London houses.

Mr. Joseph Smith, of Thorpe Hall, Hasketon, who shows a farm in Class III., owns an old-established flock, and has been a very successful exhibitor.

There are not, it is believed, more than two or three flocks of the old horned Norfolk breed now in existence.

To give an idea of the weights to which these sheep attain, we may mention that Mr. Joseph Smith exhibited two-shear wethers at the Norwich Fat Cattle Show in 1880, whose live-weight was 280 lbs. each; shearlings, 261 lbs., and lambs 190 lbs. each. At Islington last year, three shearlings shown by Mr. Robins weighed upwards — the three — of 8 cwt. Three lambs shown by the Marquis of Bristol weighed together 5 cwt. They are also very prolific breeders and excellent milkers, and are much in demand for crossing purposes.

The Suffolk Punch and Norfolk Cob have been as "household words," dating back to the earliest periods of rural history. The former is a favourite in the county which gives its name, but does not take root to any extent in others. An excellent stamp of Cob is yet to be found in many districts in Norfolk, but less so perhaps than at an earlier period. The Shire horse is rather extensively bred there, the best finding a ready sale for railway and town work.

Physical Features and Agriculture of Suffolk.

Suffolk is a maritime county in the east of England; it is bounded on the E. by the North Sea, on the N. by Norfolk, on the W. by Cambridgeshire, and on the S. by Essex. The chief rivers are the Bret, Stour, Gipping, Orwell, Deben, Alde and Lark. The surface of the county is generally flat, falling away into marshes on the N.W. and N.E. borders. The coast-line is low and marshy, or lined with shingle, or gravel and red loam, and is about 50 miles in length; it is fairly regular, without any indentation of note, and only one promontory worthy to

be so called, viz., Lowestoft Ness, the most easterly point in Great Britain. The greatest length from E. to W. is 50 miles; the greatest breadth from N. to S. is 28 miles; and the gross area is 947,681 acres.

Lower Eocene rocks, chiefly London Clay, form a small tract in the S., to the E. and S.E. of Sudbury, another small tract around Saxmundham, and a narrow belt along the coast to the S. of Aldborough; Upper Tertiary rocks, chiefly Crag, form a considerable belt on the sea-board, all to the S. of Lowestoft; and Upper Chalk rocks form the rest of the area; but the chalk is to a large extent covered with more recent deposits, and the Boulder Clay of the glacial drift forms the surface of a large tract of land in the centre of the county.

There is perhaps not a county in the kingdom which contains a greater diversity of soil, or in which the various soils are more clearly discriminated. They range from the heaviest clay to the lightest sand; the larger proportion in the centre consists of strong loams, a considerable belt of sand extends along the E. coast, and one of smaller extent is on the W. side of the county. In the N.W. corner is some fen-land, while a corner on the S.E. contains a rich loam.

The following are the returns made to the Board of Trade of the acreage of land under crops, for 1884 and 1885:—

	1884.	1885.
Total area under cultivation	780,013	781,860
Corn crops:—		
Wheat	133,242	118,531
Barley	143,171	154,217
Oats	19,323	23,306
Rye	5,626	6,736
Total	301,362	302,790
Green crop:—		
Potatoes	2,463	2,296
Turnips and Swedes	58,174	56,625
Mangolds	33,027	35,777
Carrots	796	1,034
Cabbage, Rape, &c.	2,678	3,541
Vetches, &c.	21,670	25,441
Beans and Peas	64,409	67,141
Rotation Grasses	85,062	87,119
Bare Fallow	36,364	28,151
Total	304,643	307,125
Permanent Grass	173,664	171,727

From the foregoing figures it would appear that this county, like Norfolk, is mainly cultivated under the four-course rotation. Barley and wheat are the chief crops grown, no less than 50 per cent. of the acreage under corn crops every year being in barley. Oats seem to have been sown in larger quantity in 1885 than in 1884, probably being worth more per acre than wheat. A considerable acreage was in bare fallow—this no doubt results from the large proportion of strong soil in the county; in comparison with Norfolk as to this it stands as 3 to 1. Permanent grass forms about 22 per cent. of the total area under cultivation.

The climate of Suffolk is cold in the spring, but very dry. The average rainfall for the 15 years from 1866–80 was only 27·72 inches per annum, being thus nearly 1 inch in the year less than the mean fall in Norfolk during the same period. Frosts are severe, and N.E. winds are sharp and prevalent; on the whole, however, the climate of this county must be reckoned favourable.

The Live-stock Statistics may be thus summarised:—

Horses:—

Used solely for agricultural purposes	33,364
Unbroken horses and mares kept solely for breeding purposes	9,797
Total	43,161

This gives one pair of working horses to every 40 acres of land under cultivation; or one pair to every 36 acres of arable land.

Cattle:—

Cows and heifers in-calf or milk		22,804
Other cattle		47,302
Total		70,107
Bred in the county during one year		8,658
Died from disease or accident	1,290	
Slaughtered for meat on holdings	3,498	
		4,788
		3,870

Most of the cattle in the county must, according to the above figures, be imported from other parts of the kingdom, and there is no doubt that thousands of cattle are brought in annually from Scotland and Ireland. Our statistics only show 1 beast to every 11 acres, but we must consider that, as in Norfolk, there are thousands of cattle never returned at all,

being bought, fattened, and sold again before the returns are issued.

Sheep:—

One year old and above		231,179
Under 1 year old		215,879
Total		447,058
Bred in the county during one year		60,795
Died from disease or accident	8,345	
Slaughtered for meat on holdings	9,111	
		17,456
		43,339

It will be seen that, as with cattle, so most of the sheep must be bought in from other counties, as according to the returns only about 10 per cent. of the whole of the sheep stock are reared in the county. There appears to be only 1 sheep to $1\frac{3}{4}$ acres.

The total number of pigs in 1885 was 135,525, a decrease of 19,000, or 14 per cent., as compared with the previous year.

Pigs:—

Bred in the county during one year		71,705
Died from disease or accident	6,592	
Slaughtered for meat on holdings	43,270	
		49,862
		21,843

In Suffolk, as in Norfolk, great improvements appear to have been effected by marling or claying the weak sandy soils on the eastern and western sides of the county, and also on the fen-land at its north-western corner.

It also seems to have been applied to soils of a heavier nature. A correspondent of the Board of Agriculture in 1796, with reference to Suffolk practice, writes, "Clay is thought to be as good a manure for heavy as for light land; and it is a constant practice to lay clay upon clay land, especially if the land has been laid down with grass seeds for some years." But what is peculiarly striking is to find that this practice, from which such immense benefits seem to have been derived, is now generally abandoned. The only approach to it—and it is a very distant one—which we found on any of the farms visited was at Mr. Learner's, who occasionally uses a light dressing of chalk-marl found in the valley of the Bure, as a corrective for finger-and-toe in his turnips. Whenever a report of the

farming of the two counties is written, this will form a subject of interesting enquiry.

When Arthur Young wrote, a considerable portion of the county, on the strong loam in its centre, was chiefly devoted to dairy purposes.

He instances a tract of 20 by 12 miles, bounded by the parishes of Coddenham, Otley, Lethringham, Hacheston, Bruisyard, Cookly, Metfield, Wingfield, Brandeston, Westrop, Wynerston, Creeting, and again to Coddenham, with all the places within. This locality was the head-quarters of the Suffolk cows, which had then been long celebrated as great milk givers, to an extent which he believed much exceeded that given by any other breed in the island—quantity of food, and size of animal, taken into account.

I have already noticed this breed, in dealing with Norfolk, as being the origin whence sprung the present Red Polled Cattle. They were then generally, but not universally, polled; and the calves showing a tendency to horn were not reared, but disposed of when young. The colour at that time was not uniformly red. Young says, "the best milkers I have known have been either red, brindle, or cream colour."

As to milk, "there is," he says, "hardly a dairy in the district that does not contain cows which give in height of season 8 gallons of milk per day, and 6 are common among many for a large part of the season. For two or three months a whole dairy will—for all that give milk at all—average 5 gallons a day, which *for cows of this size* is very considerable."

Another peculiar circumstance in the management of the cows which he mentions, is, "that of tying them up in the fields, without house, shed, or roof to cover them. With rails and stakes they form a rough manger; and the cows are tied to posts about 3 feet from each; at their heads is a screen of faggots. Litter is given them regularly, and the dung piled up in a wall behind."

The larger proportion of the grass on this heavy land has been broken up, and as a consequence both cow and dairy have very generally disappeared.

The Suffolk breed of horses in Young's time were, he says, no less celebrated than the cows. The best sort was to be seen in the "Sandlings," south of Woodbridge and Orford. About forty years before Young's time, a practice prevailed of testing the strength and endurance of these horses by drawing team against team for large sums of money. Mr. May, of Ramsholt-dock, was said to have drawn 15 horses for 1500 guineas. Considering the difference in value of money between now and then, this put racing matches of the present day in the shade.

Young remembers seeing some of the old breed which were famous, "and in some respects an uglier horse could not be viewed; sorrel colour, very low before, large ill-shaped head, with slouching, heavy ears, a great carcass, and short legs, but short-backed, and more of the *punch* than some will allow." He goes on to say that "they could only walk and draw, but could trot no better than a cow," but admits "that of late years they had changed to a handsome and most active horse," and thinks "that in useful draft of cart and plough they would beat the great black horse of the Midlands." "The fair comparison would be, let a given sum be invested in the purchase of each breed, and then by means of which will 1000 tons of earth be moved to a given distance by the smallest quantity of hay and oats. It is the hay and oats that are to be compared, not the number or size of the cattle."

Carrots were at that time very largely used as food for horses, and, as it appears from Young's description, were considered the most economical that could be given them, equal to a combination of corn and hay, and keeping them in vastly better condition.

Thirteen bushels per week were sufficient for one horse, without any corn whatever, and he ate only half the hay that a corn-fed one did. Prime cost per bushel, calculated at 3*d.* and 3½ stones of hay, per week 1*s.* 6*d.*, making the total weekly keep 4*s.* 9*d.*

This, it must be admitted, sounds most economical, and though about 1000 acres of carrots are grown annually in the county, only on one of the farms, Mr. Horace Wolton's, did we find them extensively used as horse-food; and as a stimulus, at least, to enquiry we give Young's conclusion as to this in full. "I cannot," he says, "conclude the subject, without earnestly calling on all persons who have sands, or light sandy loams, to determine to emancipate themselves from the chains in which prejudice, or indolence, have bound them. To cultivate this admirable root largely and vigorously; to give it the best soil they have; to plough very deep; to hoe with great spirit; and to banish corn from their stables, as a mere luxury and barren expense that ought to be extirpated; an effect that flows very fairly, from the preference which the instinct of the four-footed inhabitant generally gives to the carrots."

Beet, which has been a valuable acquisition to heavy-land farmers in Suffolk, furnishing a supply of spring and early summer food for stock, is a comparatively recent introduction, first heard of about 1810.

Suffolk has long been famed as one of the chief centres in the kingdom for the manufacture of some of the most

important implements that are required on the farm. The fame of the Ransome plough and Garrett drill is world-wide. In Young's time he was not aware of a threshing-mill in the county, and instances a practice then common in the neighbourhood of Newmarket where wheat for seed was then largely grown. The sheaves were opened as soon as got into the barn and partially threshed—"topped out"—by which means the boldest and best matured grains only were obtained, and the sheaves again tied up for threshing at a future time. This seed, which was grown on the "White land," was in demand, and made high prices to North-country farmers.

The skill of the Suffolk ploughmen was remarkable in Young's day, and no one can pass through the county at the present day without concluding that in respect to this the mantle of their forefathers has descended to the present generation.

The Competition.

But to return to the competition; it is a matter for regret that the entries in Class I. were so limited, especially as it is well known that within the bounds of the county are many large farms whose management, if detailed, would have fully sustained the reputation which so long and so generally has been ascribed to Norfolk farming, and, moreover, proved instructive to the readers of the 'Journal.'

I must not, however, be understood to reflect disparagingly on those farms that were entered; the management of both will be found interesting, and the first-prize farm especially good; but it partakes so much of the suburban as to render it almost outside the pale of ordinary farming, and hence cannot be considered a fairly representative one, or its practice as affording a fair reflex of those large farms existing in various parts of the county.

On the evening of Monday, November 16th, the Judges appointed by the Society to award the prizes in the Farm Competition met the Secretary, Mr. H. M. Jenkins, at Norwich, and were by him supplied with maps of the localities in which the competing farms were situated, lists of entries, and all other necessary information relative to the work they had undertaken, and on the following morning they commenced that work.

The next inspection made commenced on Monday, May 3rd, and the final round on July 2nd.

I may here state that at our second inspection we decided that as to the farm in Class III., occupied by Mr. W. S. Grimwade, it would be unnecessary to visit it again, and that the same decision would apply to Mr. Wm. Webster's farm in Class IV.

After our second inspection, it was apparent enough who the first-prize winners in Classes I. and II. would be; but the merits of the others, after the above elimination, approximated so closely, that another examination with careful deliberation was necessary before we could draft any of them, and award the prizes to the others. It affords the Judges pleasure, however, to be able to say that, though they considered the defeated competitors fairly enough beaten, they were not by any means disgraced; and that the arable management of Mr. Joseph Smith, Walnut Tree Farm; Mr. Henry Smith, Long Melton; and Mr. Edwin J. Durrant, of Wimbotsham, was very excellent, and reflected much credit on them respectively.

I must now insert the list of prizes which were offered by the Norwich Local Committee for the best managed farms in the counties of Norfolk and Suffolk, with the conditions attached to their entry, and the points which the Judges were to consider in making their awards.

The prizes were for four classes of different sized farms, viz.:

Class I.—For the best-managed Arable and Grass Farm exceeding 550 acres, 100*l.*; for the second best, 50*l.*

Class II.—For the best-managed Arable and Grass Farm of 250, and not exceeding 550 acres, 75*l.*; for the second best, 25*l.*

Class III.—For the best-managed Arable and Grass Farm above 100 acres, and not exceeding 250 acres, 50*l.*; for the second best, 25*l.*

Class IV.—For the best-managed Arable and Grass Farm, not exceeding 100 acres in extent, 25*l.*; for the second best, 10*l.*

The competition in all classes was limited to tenant farmers paying a *bonâ fide* rent for at least three-fourths of the land in their occupation, the whole of which was to be entered on the Certificate of Entry.

The Judges were instructed to take into full consideration any special advantage one competitor might have over another; and to withhold prizes in the absence of sufficient merit in any of the competing farms.

In arriving at their decisions they were also instructed especially to consider:—

1. General management with a view to profit.
2. Productiveness of crops.
3. Quality and suitability of live-stock.
4. Management of grass land.
5. State of gates, fences, roads, and general neatness.
6. Mode of book-keeping followed (if any).
7. Management of the dairy and dairy produce, if dairying is pursued.

The annexed Schedule gives full particulars of the Farms entered, together with the Awards of the Judges, &c.

SCHEDULE OF FARMS entered for the NORFOLK and SUFFOLK COMPETITION, 1886.

Name and Address of Occupier.	Landlord.	Area. A.	R.	P.	Nature of Soil and Subsoil (as described by Tenant).	Remarks.
Class I.						
Taylor, Garrett, Hall Farm, Whitlingham	The Corporation of Norwich, and Messrs. J. and J. Colman, Norwich	838	0	10	Mixed. Some Clay and Marl, but mostly Gravel	1st Prize.
Wolton, Horace, Newbourn Hall, Woodbridge	Sir Chas. Rowley, Tendring Hall, Essex	843	0	0	Light. Crag and Sand principally	2nd Prize.
Class II.						
Durrant, E. S., Wimbotsham, Downham Market	Thos. L. Hare, Esq. and Mr. Clubbe, Bexwell	476	0	0	Heavy and light. Strong clayey Marl and Sand ..	Commended.
Learner, Edwin T., Burgh, Aylsham ..	Exors. of E. Burr, Burgh, Aylsham ..	344	0	0	Mixed. Various	1st Prize.
Procter, W. S., Bexwell, Downham Market	J. G. Morris, Esq., Allerton Priory, Allerton, Liverpool	377	0	0	Heavy and mixed. Varied Clay and Peat	Equal 2nd Prize.
Sherwood, S. R., Hazlewood, Friston, Saxmundham	T. V. Wentworth, Esq., Yorkshire ..	461	0	0	Light and mixed. Mostly Sand; a little Clay ..	Equal 2nd Prize.
Smith, Henry, Great Melton, Wymondham	Rev. H. E. Lombe, Bylaugh Park, East Dereham	374	0	0	Various, greater part mixed, mostly Clay and Brick-earth	Commended.
Class III.						
Bayly, John, and Son, Hardingham, Hingham	Earl of Kimberley, Kimberley Hall ..	221	2	31	Various	2nd Prize.
Grimwade, W. S., Broughton Hall, Stonham	Trustees of late Sir W. F. F. Middleton, Needham Market	231	2	0	Heavy Loam. White and strong blue Clay	Commended.
Smith, Joseph, Thorpe Hall, Hasketon	J. Clarke, Esq., Beech-hanger, Caterham Valley	168	2	22	Heavy Loam.	
Turner, S. R., Hunston Lodge, Bury St. Edmund's	A. M. Wilson, Esq., and Major Heigham	234	0	0	Heavy, except 30 a. mixed, chiefly stiff Clay	1st Prize.
Class IV.						
Devereaux, Chas., Starston, Harleston	Miss E. Barton, Thornhaugh, Croydon	88	0	0	Heavy Clay	1st Prize.
Scrutton, E., Brandeston, Framlingham	C. Austin, Esq., Brandeston Hall, Wickham Market	47	3	10	Heavy Clay	2nd Prize.
Webster, W., Stoke Holy Cross, Norwich	H. Birkbeck, Esq., Stoke Hall, Norwich	79	0	0	Light and Heavy. Blue Clay. Gravel. Bog ..	

Class I.—First Prize 100*l.*

This was awarded to Mr. Garrett Taylor, Trowse House, Norwich, for the Whitlingham Hall Farm, the property of the Corporation of Norwich, and a farm adjoining, the property of Messrs. J. & J. Colman.

The former consists of:—

	A.	R.	P.	A.	R.	P.
Arable land ..	300	0	14			
Pasture	41	0	13			
Marsh	137	0	5			
Osiers	12	0	0			
Roads	4	3	33			
Wood, &c. ..	1	1	24			
				496	2	9
Messrs. Colman's land:—						
Arable	285	3	28			
Pasture	47	3	14			
Wood, &c. ..	7	2	39			
				341	2	1
Total				838	0	10

The Corporation property is held on lease for ten years dating from Michaelmas 1885, with covenants based on the Agricultural Holdings Act, 1883. Messrs. Colman's farm is occupied on a yearly tenure, the tenant being safeguarded by the provisions of the aforesaid Act. The rent paid for the entire holding is 1236*l.* 5*s.* 0*d.* per year. The rates and taxes for the year 1884–5 were as under, viz.:—

	£	*s.*	*d.*
Poor and Lighting rates, Trowse Parish	138	5	4
Highway „ „ „	7	8	9
	£145	14	1

The School Board rate is 30*s.* per child for all from the farm in Whitlingham parish who go to the Trowse Board School. The roads are all kept up by the tenant, he being the sole occupier and there being no public roads. Mr. Taylor's tenancy of the farm dates from 1877, but there was early in 1885 great probability of him being unable to re-hire the land of the Corporation, and he was therefore prepared to give up the whole; hence it is obvious that no preparation in anticipation of showing the farm could have been made.

Besides the above, Mr. Taylor occupies Kirby Farm, of

274 acres, which adjoins, and which he has farmed for three years, but he was prevented from entering it for competition owing to the close of entry before he was able to arrange for a continuation of his occupancy. At Sall, distant some 17 miles, he rents another farm of 215 acres.

Stock from the Exhibition Farm is moved to these as occasion requires, and they were all open to the Judges' inspection.

Although farming so largely on his own account, Mr. Taylor has since 1869 acted as agent for Mr. Colman, having the entire management of Easton Farm, with its famous flock and herd, besides estates and City property belonging to the firm of J. and J. Colman; yet notwithstanding the strain and attention continuously involved by such business, he took so prominent a part in the work of the Norwich Local Committee, that the Mayor at the Society's Annual Meeting stated, "that he had been its life and soul," and "that the successful arrangements effected by it were in a great measure due to Mr. Taylor's assiduous untiring exertions." And at the first Council Meeting held after the Show, the thanks of the Society, proposed by Colonel Kingscote, and seconded by Sir John Thorold, were voted to him, and the proposers stated "that to his exertions much of the success of the Show must be attributed, as their wants were always anticipated."

These remarks are so much in keeping with the impression made on the Judges by the energy displayed in the farm management, which met them at every turn, that although they touch more directly on the personal than may be considered desirable, yet in consonance with common fairness I feel bound to give them record here.

Situation, Soil.—The Whitlingham Farm is situated about 3 miles from Norwich, Mr. Colman's land adjoining on the west. The marsh-land excepted, it may be described as undulating rather than continuously level. Both grass and arable are light porous soils, for the most part resting on a gravel subsoil, too porous to be naturally fertile, and entailing frequent and liberal applications of manure to maintain artificial fertility. It readily succumbs to drought, and dry seasons disastrously affect its produce,—such a season as the present "scalding" the brows and thinner soils most effectually, and rendering the produce on them almost nil.

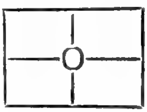
The marsh land is skirted by the River Yare for one mile, and is used chiefly for grazing young cattle and horses, the herbage being coarse and void of feeding quality, and not sound for sheep. As indicative of value, I may mention that cattle feeding on the sewaged rye-grass pasture do better without cake, than on the marshes with it. The marsh land is divided

into compartments by dykes, and is accessible by bridges thrown over them. It is protected from the river by embankments, but overflows frequently occur in the higher reaches of the river above Norwich, and, sweeping down on the land-side of the embankment, lays the land under water to the great detriment of the grazier and the deterioration of the grass. This is somewhat obviated by the system of pumping well known on the low-lying lands in the Eastern Counties, the pumps here being worked by a moveable engine.

Geologically, a small area of the farm rests on the Upper Chalk, succeeded by the pebbly gravel and sand of the Norwich Crag. Over other portions, sand and gravel of the Glacial Drift are found, while a piece of river gravel, with alluvium in the marshes, are Post-Glacial deposits.

Farm Buildings.—These call for little comment. They comprise one principal set, rather inconveniently situated almost at the east end of the farm, at which is the farmhouse, and where are kept the dairy cows and working horses, and three outlying yards on other parts of it. The first named are old, but have been largely added to and improved at considerable cost by the tenant, and are now commodious and fairly convenient.

The barn, granary, engine-shed, root-houses, and cutting and mixing rooms, occupy the north end. Two ranges of houses run at right angles from it, giving standings for 100 cows, and enclose a space large enough to form four yards. The cows are fed from passages running along at the stall heads, and communicating with the root-houses, the dung being thrown into the yards. At the south end are stables for cart-horses, calf-pens, &c. At the junction of the four yards a large circular water-trough is placed so as to give water to all, thus:—



To the west of these are two sheds, of the same length and running parallel; one has been recently built by Mr. Taylor as an implement store, on one side; and on the other are loose boxes for calving cows, &c. The other shed gives accommodation for the joiner and blacksmith shops, a small malting and cart-shed, &c., most of which were also built by the tenant.

The liquid, of which there must be a considerable quantity, taking into account the number of cattle and the large open yards, is conveyed to a tank, and from there carted out to the grass-land adjoining.

Among other buildings erected at the tenant's cost is a silo, which he built in the year 1883. Those who have had experience in ensilage, well know that success partly depends on amply treading the materials as they are put into the silo, and that the employment of manual power to do this constitutes a large part of the expense of the process. Attempts have been made to accomplish this by the use of a horse, whose weight gives a power equal to six or eight manual treaders; the difficulty being to get him into and out of the silo after the first day's filling. The situation and construction of Mr. Taylor's silo so well overcomes this, that a plan and description are well worth a place in this Report.

An old gravel pit, situated between the sewaged grass and the farm-buildings, offered an eligible site, and its capabilities are certainly made the most of. It was formed by excavating gravel from the side of a hill, and the walls of the silo built in it, at the eaves of the roof, are level with the surface above, from which it is filled; and the floor being level with the surrounding ground below, it is both filled and emptied with great facility.

A reference to the accompanying illustrations (Figs. 1–3, p. 588) will show that the silo is divided into three compartments of 19 by 14 feet, and 12 feet in depth, and that each is filled from folding doors forming part of the roof.

The compartment marked A is filled first, the horse walking in on the level, and at the end of the first day's work he is brought out by the way he entered, by an inclined plane formed of rough boards. At the beginning of the second filling he enters the same way; and at the end of it he gets out by the door at the top, when he enters for the third filling, which usually completes the compartment. The same process is repeated with the other two; and as the chaffed grass falls direct into the centre of each, both filling and treading are done with great economy. The arrangement for emptying is equally good. Eight-feet doorways in the partition walls enable a cart to be backed to the inmost compartment, and the silage from any part of the silo to be filled directly into it. Its capacity is about 150 tons. Cost 90*l.* The walls and floors being of concrete and gravel being on the site, together account for the cheapness of its construction.

Besides the above, there is at the outlying yards another silo capable of storing 60 tons. Dead-weight in the shape of old metal is the pressure used to both.

Cottages.—There were nine of these on the farm, the remainder of the labourers being housed at Kirby, Trowse, and Bexley, adjoining parishes.

Sewage from the city of Norwich, with a population of about

Figs. 1–3.—*Illustrations of Mr. Garrett Taylor's Silo.*

Fig. 1.

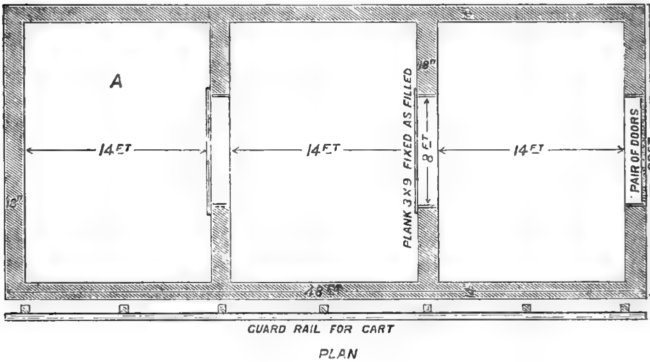


Fig. 2.

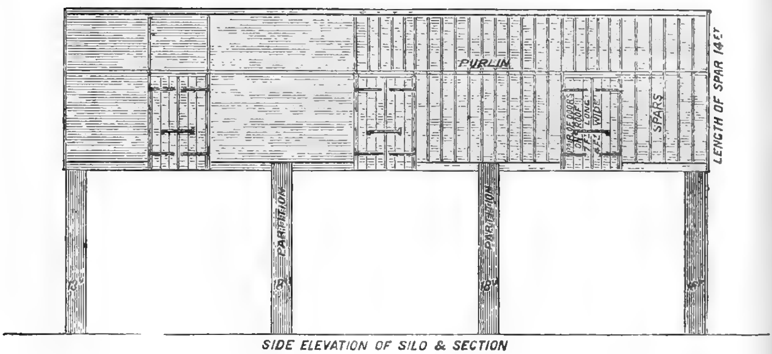
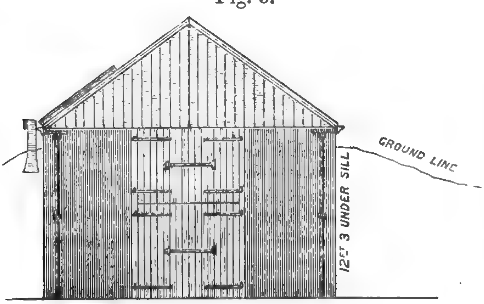


Fig. 3.



LEGEND.

Sill, 4′ × 9′. Spars, 2¼′ × 3′. Purlins, 3½′ × 9′. Ridge, 1½′ × 7′. Covered with Red Tile. Gutters, 5 inches. Door Jambs, 4′ × 18′. Inside, 4′ × 18′.

90,000, is pumped on to the highest point of the Whitlingham Hall Farm and spread over an area of 282 acres. The quantity delivered per twenty-four hours approaches nearly four million gallons. But as a matter of fact this is very poor, both the spring and storm water going into the sewers and becoming mixed with the sewage proper, rendering the quality variable and more difficult to utilise, while the cost of pumping to the city is much greater than if a separation were effected. Nevertheless this enormous quantity—poor in quality, though it may be—confers great manurial power on the farm, stimulating the growth of large crops of grass and roots, while the suburban situation offers facilities for the ready disposal at fairly remunerative prices of any surplus left after feeding such a large head of stock as are always on the place.

The cropping as to 142 acres is a two-course rotation of roots and corn, chiefly mangolds and oats; but a few acres of swedes are occasionally grown.

The sewage is turned on the stubbles about the middle of October, and allowed to run there during the winter months as a dressing for the root crops, ploughing being deferred until it is sufficiently saturated in the spring. If the surface were to be broken by the plough or cultivator, so incohesive is the soil, that it would wash into holes and hills; the stubble is thus necessary to hold it together, and acts as a filter. This, it will readily be seen, forms a great obstacle to clearing the land from weeds, a short time only in spring being available for the purpose, necessitating the free use of hoe and spud among the growing crops, as long as is possible. The after-cultivation is ploughing, and two or three harrowings. The land is once rolled; and the seed, 8 lbs. per acre for mangolds, is drilled on the flat. The quantity of swede seed drilled per acre is 3 pints, and then no more irrigation is given until it is again an oat stubble.

No other manure is necessary, and the crops grown from sewage only are very fine; the mangolds especially so. Swedes get too big and suffer in quality, which accounts for the limited acreage grown. The mangold crop, which was being secured on our November visit, was the largest and finest we ever saw. Certainly above 40 tons per acre.

This year the area under mangolds is 51 acres, swedes 15 acres; and if the crop of last year may be taken as a criterion, we should be safe in putting the probable yield of this year's sewaged roots at over 2500 tons. Over this part of the land the sewage is applied as described, biennially, none being required for the corn sown after roots. Black Tartar Oats is the variety grown, and generally do wonderfully well after sewaged mangold, yielding an average of 9 to 10 quarters per acre. The land is

once ploughed, and harrowed according to requirement. Seed drilled is 4 bushels per acre. Rolled with heavy three-horse roll. Twice horse-hoed and hand-weeded; 59 acres sown, but one piece of 34 acres was part used for lamb feed when they were weaned, and the rest mown and put into a silo just as it was coming into ear, and a crop of white turnips taken after. The seeding for wheat is 9 pecks per acre, with cultivation much the same as for oats: 14 acres are in wheat this year, but this has not been irrigated for three years.

The other part of the sewaged land, 140 acres, is in Italian rye-grass, treated as a permanent crop, and renovated annually with one bushel of seed per acre, sown over the whole. This has been seeded down at various times, Mr. Taylor's opinion being that the oldest layers are now the best. The sewage is turned on about the end of March and continued to the middle of October, being diverted from plot to plot as occasion requires, three men being constantly employed to attend to the irrigation. The grass is usually ready for feeding in April, and can be mown in May; but as a rule it is fed by ewes and lambs, colts and neat stock, the best parts being reserved for the dairy cows as the earliest green food they can get.

Stock of all descriptions do well on it; but it is perhaps better adapted for grazing cattle and horses than for sheep, a great deal of attention from the shepherd being required to keep the latter sound in hoof.

Iron hurdles on wheels are used to form the necessary separate enclosures, and the sewage grass is parted from the arable by a mile and half of iron fence, 5 feet 6 inches high, put up by the tenant.

In connection with the sewaged land silage has proved a most serviceable adjunct. Before its introduction the surplus grass had to be made into hay, and only those practically experienced know the difficulty of converting highly-sewaged herbage into a condition to render it safe from combustion in the rick. On page 588 we have given an illustration of a silo erected by Mr. Taylor, and filled with chaffed sewage grass, which is found to be a most useful auxiliary winter food, alike for dairy cows, young stock, sheep, and horses, all of which eat it with avidity, and do well on it when mixed with corn, chaff, cut straw, or the tops and bottoms and outsides of haystacks.

Another point worth noting is the disposal of the effluent water, which, falling to the valleys on the sides of the sewaged land, is caught and utilised for the growth of osiers, 12 acres having been planted for this purpose; and it may be truly said, that here "the fragments are gathered up and nothing is lost." 52*l*. was received for osiers sold in February.

Cultivation and Cropping of Non-Sewaged Land.—About 300 acres of arable, which do not come within range of the sewage, lie well together at the Norwich end of the farm, and is not encumbered with hedges, 280 acres being in one block within a ring fence, but tolerably accessible by roads which run through it. It is farmed on a four-course rotation, of seeds, wheat, roots, and barley; but occasionally—and this practice we found on several of the farms—a piece of wheat-stubble is sown with barley instead of roots.

This year about half is in wheat and barley, the other half in roots and clover.

One piece of wheat had suffered much from the severe winter, the plant probably was thrown out in the spring, and was decidedly thin, but the heads and stems showed evidence of great vigour. The other pieces were very good, and looked like yielding as much as could be expected from such weak land.

Barley, 70 acres, was thick on the ground; and, except in some places where the drought had laid hold, was a very good crop. The straw throughout was short, but well-headed, and rain falling opportunely, the yield would doubtless prove satisfactory.

The roots, 54 acres being swedes and 20 acres mangolds, were exceptionally good, and gave promise of attaining to large crops.

Clover, 72 acres, had all been mown and made into hay before our last visit; but the "Ollands" were much burnt up, indeed not a blade of green was to be seen. In all probability the first crop had also suffered; but Mr. Taylor mentioned that his practice—which is a sound one—of dressing his clover layers with farmyard-dung in the early spring months, had to a great extent saved the crops, acting as a buffer to the sun's rays.

For *wheat*, 12 loads of farmyard-manure is applied per acre; the land is ploughed, harrowed, and drilled with seed at the rate of 9 pecks per acre. Varieties, "Square Head," "Webb's Challenge White" and "Kinver's Giant White." After cultivation:—once heavy rolled, twice horse-hoed and weeded.

Barley, after roots, twice ploughed, harrowed and drilled with 10 to 12 pecks of seed per acre; land rolled and weeded. Forty acres had 1 cwt. of nitrate of soda per acre, besides a part of the root-crop having been folded with fatting sheep; 9 acres had no artificial manure, but had been well folded with fatting sheep; this is sown with Webb's barley.

Six acres under experiment for the Norfolk Chamber of Agriculture, had been dressed with various sorts of manures; 14 acres, sown after wheat, also under experimental treatment with manures, had been sown with Carter's Prize Prolific.

Mangolds after Wheat, 20 *acres.*—Three times ploughed, harrowed, cultivated, rolled, and drilled with 8 lbs. of seed per acre on the flat in May. Horse-hoeings three, plants singled, and thrice hand-hoed; sown with Webb and Sons' Yellow-fleshed Tankard.

Fourteen acres of the above are also under experiment with manure. Sown with Carter's best Tankard.

Six acres received 12 loads of farmyard-dung, 3 cwt. of bones, and 1 cwt. of sulphate of ammonia per acre.

Swedes after Wheat, 54 *acres.*—Thrice ploughed, the first time as soon as possible after harvest. The spider-harrow,* Barker's Patent (pp. 559 and 560), attached to the plough, is used to shake out the weeds, and leave them on the surface, and is favourably spoken of by Mr. Taylor and his bailiff. Cultivated in spring, rolled and drilled in May and June, with three pints of seed per acre. Horse- and hand-hoed as for mangolds.

Eleven acres of these under experiment as aforesaid are sown with Townsend's *Defiance*.

Ten acres are dressed with 4 cwt. of bones, 1 cwt. of sulphate ammonia, and 1 cwt. of gypsum per acre.

Twenty-nine acres manured with 14 loads of farmyard-manure, and 3 cwt. of superphosphate per acre, are sown with Webb's Imperial Swede.

Four acres had been folded with sheep, and dressed with 3 cwt. of superphosphate per acre.

No doubt the results of the experiments conducted for the Norfolk Chamber of Agriculture will in due time be published, and it is also to be hoped that the results of Mr. Taylor's various manurings may be tabulated with them.

The whole of the arable land and crops was fairly clean. Indeed, considering that they were not in holiday attire, no preparation having been made with the view of showing the farm, most creditably so. The artificial manures purchased in 1884–85, and applied to the non-sewaged arable land, in value amounted to 227*l.* 17*s.*

From the foregoing it will be gathered, that though the grain crops on the farm are by no means unimportant, yet in the forage and its utilisation centres the greatest feature. The suburban situation enables considerable quantities to be sold at remunerative prices, and to give an idea of what is done in this line, we may mention that between July 1st, 1885, and June 30, 1886, hay and straw to the value of 980*l.* were sold off, besides 400 tons of roots. But the great bulk is consumed on the farm

* This is made by Murton and Turner, of Kenninghall. Cost, with attachments, 2*l.* 5*s.*; it is highly spoken of for clearing light land by many who have used it.

by a large head of live-stock, to which we would now draw attention.

Cattle.—Proximity to Norwich, and the belief that sewaged grass is more profitably used as a milk-secreter than a beef-producer, probably determined Mr. Taylor to convert his forage crops into the former rather than the latter. At all events, the former is in the ascendant, and we found a large herd of dairy cows in residence as converters, constituting with their produce, which are all reared, the chief live-stock on the farm. At our November visit we found—

Cows	100
2- and 3-year-old heifers	42
Yearlings	82
Stock bulls	3
Total	227

Between November and July, one heifer had been bought and 64 calves bred; while sales to the value of 1323*l.* 5*s.* had been made, leaving a stock of 209 on the farm of all ages.

The produce of the farm is supplemented by the purchase of large quantities of feeding-stuffs—cakes, pollard, meal, &c.—as contributories to the maintenance of this large herd and flock. The amount so expended in the year 1884–5, which was an average year, was 1298*l.* 17*s.* 6*d.* As a rule, from 80 to 90 cows are in-milk. Ten cows being allotted to each milker, milking is commenced at 5 o'clock A.M. and 3 o'clock P.M. The milk is refrigerated, tinned, and despatched twice a day to Norwich by cart. Cold water for refrigerating is obtained from a well, deepened for this purpose at the tenant's expense. Ice is also in request in hot weather, and a supply is obtained from an ice-house near, also constructed by the tenant. The most of Sunday's milk, as well as any surplus of other days, is made into butter. Ninepence per gallon is the price obtained for milk in summer, and 10*d.* per gallon in winter.

The total receipts for milk and butter sold in 1885 were 2080*l.* 10*s.* 1*d.*

The breed of cattle kept is the Red Polled. The foundation of the herd was laid in 1878 by the purchase of heifers from Mr. Henry Birkbeck of Stoke, and Mr. Colman, Easton Lodge Farm; and these have been supplemented with heifers from Mr. Brown of Marham, Mr. Fulcher of Elmham, and further surplus stock from Easton; while in 1884, the whole of Mr. Henry Birkbeck's herd of 41 head was purchased for Whitlingham. This was a valuable addition, the herd having been carefully managed, and the purest blood only admitted

into it; besides, it was one of the oldest pure-bred herds in existence. That its purity and prestige will be maintained by its new owner, few will be inclined to doubt. The Norwich Champion prize bull, "Falstaff," who is in use as a sire in the herd, is an additional guarantee as to this. At the present time, the number and quality of the animals render it very interesting; and to minds imbued with tastes bucolic, the impression produced by the sight, as we on our first visit saw it, of 100 of these cows, uniform in colour and quality, stalled in houses spotlessly clean, is one to be remembered. Not one ailing or failing animal could we detect, but all in the pink of condition, with skins shining like well-groomed hunters.

The quantity of milk given by this breed of cattle is, perhaps, not on the whole so great as by some of the larger-framed breeds, but we must remember the old saw,

> "'Tis what goes in at the moo
> That makes the milking coo."

And it is quite possible that the neat little Poll renders as good an account for food consumed as any in the Kingdom, and that Mr. Taylor, as a milk seller, may be commercially right in his adherence to them. In quality the milk is particularly rich, and the cafés in the city supplied from Whitlingham have, it is said, familiarised the public with this. Another valuable trait of the breed is that most of the cows regularly yield a good quantity of milk from the birth of one calf to another, rather than a large supply for a short time.

In summer the cows are grazed almost entirely on the sewaged Italian ryegrass, which they eat with relish and thrive on,—the quality of milk, cream, and butter which they give from it being exceptionally good, and without the slightest trace of the source from which their food is derived.

In winter they have roots, hay, chaff, cakes (linseed and decorticated cotton), pollard, malt, Everett's or Barber's Condiment Meal, &c. Swedes are given to the end of February, when mangolds are substituted.

Over 100 calves are bred yearly and reared on the farm. When there is milk to spare, the young calves get it until they are about fourteen days old, when they are put on gruel made with Simpson's Calf Meal. When there is not milk to spare, which is more often the rule than the exception during the autumn and winter months, they, at two or three days old, have for food this gruel only. The meal is first wetted with cold water and worked into a paste, boiling water in sufficient quantity being poured on to scald and thoroughly dissolve it. Cold water or milk, if to be had, is added to cool and make up

the quantity required. They have this until over three months old, receiving, as soon as they will eat, linseed-meal, malt, Thorley's food—in fact any appetising food they most readily take to, and also a little sweet hay. At about four months old they are removed in lots to the off-premises and weaned from the gruel, and are then fed on pulped roots, chaff, cake, malt, condiment meal, &c.

The fatalities attending this mode of rearing do not appear to reach a larger percentage than on farms where milk is more freely used, and on the whole it is here an undoubted success. It is probably not much more economical than where a moderate quantity of milk is given—at least where milk selling is not an object—but it establishes the fact, that calves can be healthily and economically reared with little milk, or almost without any.

As yearlings, most of the steers, and such of the heifers as do not promise well for the dairy or herd, are drafted to Mr. Taylor's farm at Sall, and there matured for the butcher at about two years old. At from fifteen to twenty-one months old the heifers are put to the bull, the very best only being brought into the dairy to fill the places of cows yearly drafted. It is hoped that by following this plan, and by the use of the best bulls, that in the course of a few years the milking capability of the herd may be much improved. Up to this time little has been done in the way of selection, the milk demand increasing as fast as heifers could be bred.

Sheep.—A very valuable pure-bred flock of Southdown ewes is kept. These sheep are thought a very grand lot, combining with size, quality and remarkable uniformity. Originally started at Mr. Colman's Farm at Easton, where Mr. Taylor lived as manager, they were in 1877 transferred to Whitlingham, then 200 in number. No pains or expense has been spared in maintaining the character and purity of the flock, and rams only of approved type and blood have been used, chiefly from the flock of Mr. Henry Webb, of Streetly Hall, Cambridgeshire, and noted Royal prize-winners, also purchased or hired. The ewes now annually put to the ram number 400. The flock is kept up in the usual way by the selection of the best shearling ewes to make up for the annual drafts. It may be mentioned that Mr. Colman has yearly the first selection of 80 lambs: ewe, ram, and wether, which go to Easton Lodge Farm for exhibition purposes.

The remainder of the ewe shearlings are in demand, and sold for breeding purposes; while the wether hoggets are fattened and sold at from 10 to 12 months old, in weight averaging about 60 lbs. each.

The ewes are put to the rams on the sewaged grass, and are depastured there during the day for the most part of the year, the exception being the depth of winter. At night they are folded on the surrounding arable land, while in winter they are supplied with long hay in racks and a few roots, cut hay and pollard being added in very severe weather. As soon as they lamb they have plenty of cake, pollard, cut hay, and roots, and what grass they can find on the sewage land. As soon as the lambs can eat they are tempted with mixtures of cake, corn, &c., given in troughs outside the fold. This is kept up until they get to consume $\frac{1}{2}$ lb. per day of the mixture, which quantity suffices to turn the wethers off fat early in the new year. The ewe lambs are gradually brought back to $\frac{1}{4}$ lb. per day, and when the grass is well grown it is entirely discontinued.

The lambs are dropped in the end of February and beginning of March, and are weaned about the middle or end of June. After weaning, they have the best green food on the farm as it comes on until September, when they begin with white turnips, and in October go on to ground swedes.

The hoggets clip a little over $6\frac{1}{2}$ lbs. of wool each, the ewes not quite $5\frac{1}{2}$ lbs. each.

The fall of lambs in Norfolk last season appears to have been generally a moderate one; and the Whitlingham flock does not in this respect figure better than its neighbours, lamb for ewe being barely attained.

Pigs.—About 20 store pigs are bought at a time to consume the waste from the dairy; and besides, about 1500 stones of pork is made at one of the detached farmyards for Messrs. J. and J. Colman to give their employés at Christmas. No sows for breeding are kept. The number of pigs fattened last year was 142, and the cash receipts for them 630*l.* Some very excellent and convenient fatting pens have been arranged for this purpose at the yard above mentioned.

Horses.—Forty-six in all we found on the farm; 24 being used for ordinary draught purposes, 4 for milk-carts and bailiff's use, and 18 colts of various ages. As a rule, Mr. Taylor breeds all he requires for farm use, and also disposes annually of about 6, at 4 and 5 years old, chiefly for heavy town work. His favourite breed is the "Shire," and he keeps at his Kirby Farm a large breeding stud. At our first visit he had 11 stallions there, viz.: "Grampian," 4 yrs.; "Gracchus," 3 yrs.; "Sir Garnet," 5 yrs.; "Norfolk Wonder," 10 yrs.; "Grimaldi," 3 yrs.; "Goodwill," 2 yrs.; "Good Boy," 2 yrs.; "Camill," 2 yrs.; "Gunboat," 2 yrs.; "Grandee," 2 yrs.; "Boy Tom," 1 yr. Previous to our last visit, he had disposed of 2 of the 3-year-old stallions, and also 2 mares, 4 and 5 years old, at prices for the stallions

of over 200*l.* each, and for the mares over 100*l.* each. The earnings of 4 stallions serving mares this season amount to 450*l.*

Mr. Taylor was most open and willing to show us all and everything connected with his farming business, whether telling in his favour or otherwise; but the Kirby Farm not being exhibited, we regret we are debarred from detailing the management of the stud there, as such, we believe, would have been found interesting and instructive.

To return to the cart-horses; they are all fed on short provender, chiefly chaffed oat-straw and ordinary hay, with some silage and corn-chaff, and 8 stones per week per horse of crushed Black Tartar oats.

Their hours of labour are in summer from 6 to 11 o'clock, with 2 hours to feed and rest until 1 o'clock, and from then to 6. In winter they go from light to dark, with the interval at mid-day for feeding. This is a more rational way than that on some of the farms which we inspected, where the horses are out from 6 to 3 o'clock, with no interval at all for food, although they are stopped in the fields while their attendants have something to eat.

Labour.—The labour of the farm is performed by 40 men and 2 boys, their hours of labour being 10 per day. The total labour bill, including bailiff's wages for the year 1884–85, amounted to 1785*l.* 10*s.* 4*d.* Tradesmen's bills for the same time, 156*l.* 19*s.* 1*d.* This (*ex* the tradesmen's bills) stands to 42*s.* 6*d.* per acre, and may seem an exorbitant sum, but really is not so when the labour in excess of what would be required on a farm under ordinary management is taken into consideration, viz., distribution of sewage, milking and distribution of upwards of 50,000 gallons of milk yearly, besides butter making from Sunday's and surplus milk,* dealing on the farm with the excessively large crops of roots and grass, and carting the surplus of the same to Norwich, and considering also the large head of live stock kept.

Books.—A complete set of accounts are kept, including Labour, Day, and Cash books, with Ledger, which were offered unreservedly for our inspection; and though we satisfied ourselves that the first and most essential condition which the Society requires to merit a prize had been amply fulfilled, we do not feel justified in going farther in revelation of the "secrets of the prison house;" for although Mr. Taylor might not object to a complete copy of his accounts being published, the precedent might prove an inconvenient one—as it may be taken for granted that all competitors do not think alike on this matter.

---

* Over 2000 lbs. of butter were made during last year from surplus milk.

We have only further to add that, though the competition in this Class was unfortunately very limited, yet the practical and energetic way in which this farm is managed, and that management resulting as it does in financial success, we considered it well worthy of, and had pleasure in awarding, the first prize to its active and spirited occupier.

Class I.—Second Prize, £50.

Awarded to Mr. Horace Wolton, Newbourn Hall, Woodbridge, Suffolk.

Arable land	.. .. ..	572 acres.
Grass ,,	.. .. ..	86 ,,
Heath	.. .. ..	185 ,,
Total	.. ..	843 ,,

The owner of this farm is Sir Charles Rowley, of Tendring Hall, Colchester, from whom the tenant holds on a yearly tenure at a rent of 500*l.*, and he also pays tithe rent, 160*l.*, and rates, which average about 70*l.* yearly.

Mr. Wolton's occupation commenced in 1870, and from that date to 1885 the rent paid was 730*l.* per year, his landlord making a return during the last three years of the time; the present reduced rent commenced at Michaelmas of the last-named year.

He is not restricted to any particular mode of cropping, but by choice adheres to a four-course rotation. Hay, straw, or roots he is not allowed to sell off the farm, nor is it probable that he would sell if he had the power, nor, we might add, would it be desirable.

The late Mr. Wolton, father of the present tenant, held the farm for 58 years, and died there in his 93rd year, having spent all but two years of his life on it; and his ancestors, as family records show, occupied it for 150 years previously.

Situation and Soil.—It is situated five miles from Woodbridge, and is intersected by main roads. Taken as a whole, and as the rent truly enough indicates, the farm is a very poor one. The best soil is on the south side, and is a stiffish loam on a clay subsoil—indeed on the London Clay formation,—two or three fields of which have been drained by the tenant under the provisions of the Agricultural Holdings Act, 1883, and are cultivated on the nine-feet stitch or ridge. The next gradation which adjoins the above on the north is a sandy soil resting on the Red Crag, the remainder being a light sand—some 108 acres

of blowing sand—on the sand and gravel subsoil of the Glacial Drift.

The heath land, which is largely covered with "blossomed furze, unprofitably gay," can only be turned to account as a run for sheep.

The grass-land lies chiefly on the south side of the farm, between the patch of good arable above described and a stream —a tributary of the River Debben,—and is of second-rate quality, only affording pasturage sufficient to grow young animals, but not equal to fattening them. The only aid it gets is from the cake given occasionally to the cattle running on it.

The Red Crag, on which a considerable area of the farm rests, has been extensively used as a manure in past times; the size of a pit from which it was obtained shows that some thousands of tons must have been excavated. Its efficacy as a manure, or physical alterative to the sandy soil, is not now believed in, and it is seldom used but to form bottoms for farmyard-manure heaps, when banked in the fields.

A bed of coprolites also exists on the farm at a depth of 30 feet from the surface; this is dug and sold as an article of commerce.

Buildings and Fences.—The dwelling-house and principal farmyards are tolerably centrally situated by the side of a high road passing through the farm. Both date from primitive times; but the house, nevertheless, is very commodious and comfortable, and is kept in beautiful order under the superintendence of Miss Wolton, a sister of the tenant—he being a bachelor. The farm-buildings are quite equal to the requirements, and are in good repair.

Gates and fences were certainly not in show form. Allowance, however, must be made for the poverty of the soil rendering it, at least over the larger part of the farm, a matter of great difficulty to grow fences at all; and as Mr. Wolton explained, he was obliged to allow those to grow untrimmed where growth is possible, in order to get material to fence where it is not—an argument which the Judges could not gainsay.

The gates were in a tenantable state of repair, but several of them were unhung, fastening being secured by slipping their ends into notches cut in the posts. This practice is by no means confined to this farm, and we found it existing on several in both counties. It doubtless possesses the merit of economy, but at the expense of utility and convenience.

Purchased Manures, Cake, and Corn.—The artificial manure hitherto chiefly used has been rape-cake, the yearly outlay for which has averaged 114*l*. This year Mr. Wolton is trying dissolved bones and kainit for his root crops, with what result

is at present unknown. His cake bill averages 415*l.*, and the corn consumed annually by stock, other than horses, amounts in value to 166*l.*, this being partly bought and partly grown on the farm.

Labour. — The staff comprises 1 foreman, 2 shepherds, 8 teamsmen, 8 ordinary labourers, and 6 boys. In addition to this, 16 men and boys are engaged all the year round to dig the coprolites referred to, and these are found a convenience to the farm, as they can be called on to assist when pressure of work requires it.

The total labour for the farm, excluding the coprolite digging, averages 966*l.* 12*s.* per year, and this shows a cost per acre, excluding the heath, of something under 30*s.*

Rotation and Cultivation.—As already noted, the farm is cropped on a four-course rotation, viz., roots, barley, seeds, wheat. One-half is thus growing crops for the food and beverage of man, the other for the sustenance of sheep and cattle. But whether this mode of cropping poor lands at the present juncture is the most profitable that can be followed is doubtful. In the opinion of the Judges, an extension of the course, leaving the layers down for two years, would lessen working expenses, increase fertility by natural means, and probably tend to the maintenance of a larger flock of sheep; for although the second year's seeds might not be brilliant, they could be broken up in June, and a crop of white turnips or cole taken, largely increasing the keep, and also the condition of the land for the succeeding corn crop. Forty acres of rye are sown on the wheat stubbles, after ploughing in September, for early sheep food; the crop is folded, and the land afterwards ploughed and sown with white turnips, again to be consumed by sheep when grown.

The cultivation for roots is, first to fork the stubbles for couch-grass—Mr. Wolton remarking, "if there is any"—and the land then deeply ploughed previous to winter. Two spring ploughings and sometimes a "crooming" are given. Farm-yard-manure, as a rule, is applied for the mangolds and swedes, being spread on the land and ploughed in, harrow and roller following; and the seed is drilled on the flat at 26-in. apart.

The manure previous to application is dealt with in different ways, sometimes carted direct from the yards and ploughed in; at others carted into a heap and turned over shortly before being wanted: while another mode is to mix it into a compost with soil.

Six lbs. of mangold seed, and 2 pints of swede-seed are the seedings per acre.

Hoeing costs from 5*s.* to 8*s.* per acre. From 18 to 25 tons

per acre is considered a good crop on this sandy soil. The mangolds are secured in clamps, covered with bracken and then soil. Some are occasionally fed off where grown, but this is done before Christmas.

Swedes are generally clamped in heaps of 30 bushels each, covered with bracken and then earthed. The cost of getting-up and securing roots is from 6*s.* to 9*s.* per acre.

The root plant throughout was good, the mangolds and swedes especially so. Some of the white turnips, where rye had been fed off, were being sown at our last visit, and the rain falling so shortly afterwards would not fail to ensure a good braird.

For barley, two ploughings are usually given; but sometimes when the land is late fed it is first broken up with "Biddell's Croomes," then ploughed 7-in. deep, and well cultivated with harrows. The roots are fed off with cake for barley, as a rule; but when they are removed, rape-cake is applied as a manure. Seed, 8 pecks of Hallett's Pedigree. Some of the barley was good, some indifferent, and on the blowing sand stretching out to the heath it had suffered much from the drought, and was a very poor crop. Barley is always stacked loose.

Clover seeds are sown directly after the barley is drilled. Red clover, 1 peck per acre, with a little rye-grass, is sown on the best land; but on the weaker the mixture is,

$\frac{1}{2}$ peck red clover,
$\frac{1}{4}$ peck trefoil,
1 quart White clover,
$1\frac{1}{2}$ pecks Italian rye-grass,

and on the blowing-sand more rye-grass is sown.

The sheep are run lightly over the seeds after harvest, and in spring some of them are folded, the sheep lying on them at nights. They are afterwards ploughed up for cole or turnips. The remainder, except what is mown, are folded as often as the growth will admit, the sheep being removed at nights. Folding, or "reaching off," economises food, and is a practice indispensable on such a farm.

For wheat, farmyard-manure is applied to the clover layers, and ploughed about 6-in. deep; the land is rolled, harrowed, and drilled with 7 to 8 pecks per acre; harrowed again, then rib-rolled to consolidate, and given another strike of the harrow to finish. All the wheat is horse-hoed. Harvesting costs about 10*s.* per acre, exclusive of thatching. The work, as is usual in Suffolk, is let to his labourers, working in gangs,—14 acres being the allotted share of each man, for which he gets 8*l.*, but in addition has to hoe 3 acres of white turnips to keep him employed in wet weather or damp mornings.

Beans and peas are drilled on autumn-ploughed land, yard manure being applied for the former previous to ploughing, but none given to the latter.

The beans, which were on some of the heavy land, were very good and clean. That part of the wheat on the same description of soil was also a very fine crop, quite as thick a plant as any we saw on the farms of better land, while one large field on the sand had suffered from the drought, and was not likely to yield largely.

The farm on the whole was very clean; thistles were certainly found in abundance among the corn crops at our May visit; but these had been carefully spudded out before our last inspection, and, this excepted, the farm was remarkably free from weeds. Couch-grass was nowhere visible.

Live Stock.

Sheep.—400 breeding ewes of the old Suffolk black-faced breed are kept on the farm. The rams, six in number, are put to the ewes in the second week of October, and allowed to run with them for about six weeks. The food of the flock during this period is coleseed, clover layers, and turnips. During the winter and spring months they have a feed of turnips daily, with $\frac{1}{2}$ lb. of rape-cake each, which is increased to 1 lb. as lambing time approaches; just previous to and during lambing time $\frac{1}{4}$ lb. of linseed-cake and $\frac{1}{4}$ lb. of bran are added. After lambing they are penned on clover layers, rye, &c., the lambs running forward. They are also occasionally run over the heath-land, where there is little to be got but the young shoots of the gorse, which, as we saw for ourselves, they freely indulged in.

At weaning time, in July, the wether lambs are sold; and the best of the ewe lambs are reserved to fill up the vacancies caused by deaths and drafts in the ewe flock, the remainder being sold as shearlings at 16 months old. The average clip of wool from the ewe flock is $3\frac{1}{2}$ lbs. Owing to the fall in the price of lambs and wool, the receipts from the flock have diminished not less than 45 per cent. between the years 1882 and 1885, representing a sum of upwards of 500*l.*

Cattle.—About 60 head of cattle are sold fat from the farm annually. These are chiefly bought at ages between 18 and 24 months old. From 30 to 40 are summer grazed, and afterwards finished off on a mixture of pulped roots, chaff, cake, and meal, in quantities of from 8 to 12 lbs. per head per day, commencing at the former, and increasing to the latter quantity as the animals approach ripeness for the butcher. The mixture

does not contain roots in sufficient quantity to enable water to be dispensed with, and the animals have also the daily offer of this. An average sized bullock, say about 50 stone, gets daily 2 bushels of roots and 1 bushel of chaff.

At our first visit in November we found 62 bullocks, 40 of which were well forward; and at our July inspection all had gone except 10, and they were ready to go at any time.

The late Mr. Wolton kept a select herd of Red Polls on the farm, and was a successful exhibitor in the Show-ring. The present tenant likewise takes an interest in the breed, and besides the cattle above enumerated, we found six cows of an excellent stamp, several of them apparently good milkers, and, as Mr. Wolton assured us, "all of the old blood" and registered in the Herd Book.

Pigs.—About 100 are annually bred and fattened on the farm. They are fed on uncooked food, maize meal, pulped roots, &c., but the mixture is made 24 hours before being used.

Horses.—In this department of live-stock Mr. Wolton shines. The Suffolks have long been a speciality on this farm. Previous to the Norwich Show he possessed 85 cards, trophies of his successes in Showyards; and a reference to his prize list indicates that he is yet in the front rank of the breeders of this breed of horses. In Class 9, for Stallions foaled in 1884, the third prize was awarded to him; in Class 10, for Stallions foaled in 1885, first prize; and in Class 19, first prize for Mare and Foal; this mare, "Queen of Newbourn," also being awarded the Champion prize, given by Suffolk breeders, for the best Suffolk mare or filly in Classes 19, 29, 30, 31, and 34. He keeps 20 horses for farm work, including 8 brood mares, annually put to the horse, and from which on an average he gets 6 foals. Besides a good home demand for the produce of his stock, he frequently sells at high prices both mares and stallions for export to Australia; their clean legs, docile disposition, and hardy constitution, rendering the breed attractive there. And here I may remark that if purity of blood is indicated by uniformity of colour, the Suffolk undoubtedly stand as the only unmixed breed of horses in the British Isles. In no other can the colour be predicted with certainty before birth, the inference being that there can have been no crossing or mixing of blood for a period dating back to the mist of ages; and to produce any colour but a chestnut from a Suffolk sire and dam is not within the power of moderns, and would probably tax skill equal to that possessed on this point by the patriarchs of old.

The mares are worked up to within a week or ten days of foaling, when they are eased to half time per day. After

foaling they have a month's run with the foals, and then again put on to half-time work. At five months' old the foals are weaned, their keep after that being oats and bran, with the run of the pastures; and as soon as the barley is cleared from the fields they are run over the young clovers, and then again sent to the meadows as long as the weather is open, being taken into the yards at nights.

The cart-horses are, during the summer, fed on green lucerne in the yards, getting in addition 4 stone of maize steeped in water, and 1 stone of bran per week per horse. In winter they receive a bushel of pulped carrots mixed with chaff, and $3\frac{1}{2}$ stone of peas or oats per horse per week, with hay.

As is common in Suffolk, and Norfolk also, the cart-horses, after being fed, are turned into a well-littered yard with a shelter shed, where they remain for the night. This is an old practice, and was current in Arthur Young's time; and it is contended that it entails fewer veterinary surgeon's bills, and that a horse so treated never swells in his legs, and will hold his work several years longer than one confined in the stable.

Book-keeping.—Farm Account-Books are used to record all the farm transactions, which is done in a tolerably clear manner.

To sum up, the soil of this farm, for the greater part, is naturally poor and hungry; but yet, with a moderate outlay for feeding stuffs and manures, good crops are obtained, rent is made for the owner, employment for the labourer, and a fair return for the time of the tenant and for his capital invested in the undertaking; and though a strict martinet might take exception to the gates and fences, yet once inside them, the land is found free from weeds, and managed in such a practical and skilful way, and with stock so suitable for it, that we thought Mr. Wolton well entitled to the second prize, which we awarded to him.

Class II.—First Prize, £75.

Awarded to Mr. Edwin T. Learner, Burgh, near Aylsham, Norfolk.

Comprising Arable land	.. ..	280	acres.
Grass „	.. ..	64	„
Total	.. ..	344	„

This farm is the property of the Executors of the late Edmund Burr, of Burgh, and is held on a sixteen years' lease expiring at

Michaelmas 1887, at a rent of 593*l.* 10*s.*, and a tithe-rent charge of 120*l.*; the rates, also paid by the tenant, average about 50*l.* yearly; and the whole amount to 46*s.* per acre.

The lease contains no restrictive clauses as to the mode of cropping or the selling of produce; and availing himself of the freedom conferred by the latter, the tenant annually markets clover hay.

Situation, Buildings, &c.—The farm is situated in the village of Burgh, about two miles from Aylsham. The river Bure, navigable from Yarmouth, bounds the meadows, on which is a wharf, where manures, cakes, &c., are delivered by barge at a charge much less than if they were brought by rail; moreover, the advantages arising from this in the saving of horse and manual labour are very considerable. The farm is also intersected by main roads, while two railway stations are within two miles, and it may fairly be described as well watered, roaded, and railed.

The dwelling-house is good and commodious, nicely placed in well-kept grounds, in which some good specimens of choice coniferæ are growing profusely. The kitchen-garden adjoining is likewise in perfect order. In the drawing-room we were shown a piano purchased with prize money awarded to Mr. Learner four times in succession for the best crop of roots grown from seed supplied by a Norwich firm of seed merchants, and open for competition to the whole of their customers.

There are two sets of farm-buildings, the principal one near the dwelling-house and partly rebuilt, and added to at the commencement of the tenancy, the new buildings being seventeen large boxes, with the feeding passage in front, and a root house at the end. Branching off at right angles are three yards with shelter sheds, into which the boxes open; one doorway sufficing for two boxes, but not large enough to admit a cart. The manure, when the boxes are emptied, must necessarily be twice moved to deposit it in the carts.

The carthorse-stable and another yard form a separate block at a short distance from the above, and near to is a horse-gear, giving power for chaff-cutting, &c.

The secondary set of buildings, with yards and sheds for cattle, stable for horses, and a dwelling-house, are situated at the east end of the farm.

Soil.—Arthur Young, writing in 1804, says: "Ashby and Burgh were named to me as having extraordinary land; at the latter I found it excellent." The latter statement the Judges endorse.

The arable land is a fertile free working loam; in some places where the gravel subsoil is near, during protracted droughts, as

in the present season, it is liable to "scald," but is capable of producing maximum crops of all descriptions, and of the best quality with minimum labour. Mr. Learner's skilful and capable management is undoubted; but we could not shut our eyes to the fact of the great advantage he had over the other competitors by the superiority of the raw material he had to work on.

The pasture land is all by the side of the river, and, supplemented with 8 or 9 lbs. of mixed cotton- and linseed-cakes per head per day, it fattens three- to four-year-old bullocks weighing from 60 to 70 stones of 14 lbs.

The geological deposits underlying the farm run from the Upper Chalk which crops to the surface in a field near the river, to the Glacial and post-Glacial drifts, comprising the forest-bed series, contorted drift of loam and clay, with beds of sand, marl, and alluvium.

Rotation and Cultivation of Crops.—The four-course rotation is followed, viz., roots, barley, seeds, wheat; but from 8 to 10 acres of oats are yearly sown after wheat, they being followed by barley. This deviation Mr. Learner explains is chiefly adopted in order to get more straw, and results, roughly speaking, in 150 acres being yearly under corn-crops, and 130 in roots and clover.

The Swede Cultivation is as follows: the wheat stubbles are forked for couch as soon as possible after harvest, and the land is afterwards ploughed to a depth not exceeding 5 inches, experience having proved that nothing is gained by going deeper than this. In spring it is twice ploughed, harrowed, rolled, and ridged, farmyard-manure being spread between the ridges; they are then ploughed back to cover. The quantity applied is 8 loads, with one load of Yarmouth town manure per acre, and rarely any artificial; and the crops grown from this dressing, which we saw in our autumn visit, were marvellous—certainly upwards of 25 tons per acre. The composition and treatment of his manure heaps may, however, go far to explain it. To begin with, a large proportion of the manure is made in boxes under cover, and all of it by cattle eating very large quantities of cake, each of his large fatting bullocks consuming as much as 14 lbs. per day.

This manure is carted during the winter and early spring months into drive-over heaps—that is, the carts are driven on to and over the heap each time a load is deposited, which consolidates and prevents undue fermentation. In spring, the heaps are turned over, and after two or three weeks turned again, by which means the manure becomes well rotted and soluble, and almost every particle rendered available as plant food. Great

success attends Mr. Learner's practice in this matter, which is precisely similar to what I well remember seeing on some of the best-arranged farms in Northumberland thirty-five years ago.

The manure is filled into carts, emptied, and spread in the ridges by contract, at the rate of 6*s.* per score of loads. The quantity of seed drilled per acre amounts to from three to four pints; and after horse-hoeing the plants are struck out, singled by hand, and twice hand-hoed, at a cost by contract of 10*s.* per acre. This price is higher than we found on any of the other farms, the most of which were only once hand-hoed after singling, and of this Mr. Learner was aware; but to use his own words, "For this price I expect, and get, my crops left perfectly clean, I do."

In the autumn, part of the crop is taken up and secured in clamp—local phraseology, "the hale." Labour for pulling, topping, and filling into carts costs 6*s.* per acre. These hales are reserved to draw upon in snow, hard frosts, or other untoward weather, otherwise the roots are drawn directly from the field to the fold. Those left to winter in the field are partially secured from frost in the following manner:—A deep and wide furrow by the plough is drawn on each side of a row of swedes left standing; and into each of these furrows, four rows being pulled, are packed close, root downwards. The plough is again reverted to, and the furrows previously thrown out are turned back, and thus the produce of nine ridges are fairly well secured in a space of about 3½ feet wide, and at a cost of 3*s.* 6*d.* per acre.

Mr. Learner's experience is, that swedes keep much better protected in this way than when piled in the "hale." About half the crop is consumed by sheep on the land where grown.

Mangolds.—The cultivation for this is much the same as for swedes; but the manure, 10 to 12 loads per acre, is spread on the land during the winter months and ploughed in. At seed time, a proper tilth being obtained, ridges are made in the usual way, and the farmyard-manure is supplemented by 4 cwt. per acre of rape-cake. Mr. Learner "finds, he does," that his land responds better to the touch of rape-cake as a mangold manure than any other artificial he has tried.

The crop is secured in the "hale," and consumed in the yards by cattle; 6*s.* 6*d.* per acre is paid for pulling, filling into carts, and piling up at the "hale," and 10*d.* per rood of 7 yards for covering the latter with soil.

Barley follows the root-crop, the land for which is *twice* ploughed; sowing commences in February, and continues to the end of March; but early sowing is preferred, and a finish

not later than the 23rd of the latter month is always aimed at. The liberal seeding of 14 pecks per acre, is given.

In harvesting, barley is not bound, but carried and stacked loose, a practice severely reprobated by one of the Judges from "yont the Tweed."

This, however, is almost universally done in Norfolk, and is defended, not so much on the score of economy, as that is doubtful, but as admitting the crop to be carried two or three days earlier than it would be if tied up. Mr. Learner also contends that a brighter and more uniform sample results from it.

A deterioration of sample, and also waste, must ensue from so much of the grain protruding on the outsides of the ricks when stacked loose. In Mr. Barugh Almack's Essay on "Norfolk Farming," 'Royal Agricultural Society's Journal,' vol. v., Mr. John Hudson's practice at Castle Acre, with reference to this, is described as "that after harvest the outsides of the ricks are threshed with poles to save the corn and prevent the staining of part of it, a cloth being placed by the rick side on which the threshed corn is collected." We heard of farms where this is yet done, but not on any of those competing for the prizes.

Clover Seeds are sown with the barley-crop, the mixture on this farm being 10 lbs. of red and 2 lbs. of white clover-seed, with 2 pecks of Italian rye-grass seed per acre. This is alternated every fourth year with trefoil, so that red clover comes on the same land only once in eight years. The clover-crop is cut once, occasionally twice, and the aftermath fed off with lambs or bullocks eating cake.

Wheat follows seeds; the land, being manured with 8 loads of farmyard-manure per acre, is ploughed, and then well rolled, to consolidate previous to disintegration by the harrow. When farmyard-manure runs short, 5 cwt. per acre of rape-cake is substituted; and 8 to 9 pecks of seed are drilled per acre. The variety chiefly grown is known in the district as "Learner's Stiff Straw;" its origin being from a single head, of remarkable length and strength of stem, found by an uncle of Mr. Learner's in a field of wheat in 1851. It is a prolific cropper, and, as its name indicates, stands well, and he sells much of it yearly for seed.

As evidence of the jealous care with which Mr. Learner guards his crops from weeds, we may instance his practice in connection with the seed-fields previous to the wheat-crop. A spade-graft, about 8 inches wide by 5 inches deep, is taken off all round the margin of those fields, effectually preventing the spread of couch from the hedge-banks to them, his fiat being, "thus far shalt thou come, but no farther." This is done in

winter, and the soil is carted to form bottoms for manure-heaps; these are subsequently applied for wheat, but in the interim a crop of potatoes is grown on them, so that even in this small matter profit is not lost sight of.

Oats, when grown, follow wheat. The 7 acres grown this year were manured as to one moiety with Yarmouth manure, and the other with farmyard-dung, 5 loads, 6 stones of nitrate of soda, and 1 cwt. of superphosphate per acre. The variety is Black Tartary. The seed, 5 bushels per acre, is sown at twice, the second sowing being drilled at right angles across the first. Mr. Learner thinks he gets a larger produce from this than from sowing all at once. The seed being spread equally over a larger surface, the plants can better utilise what is in the soil, than when thickly clustered at wider intervals at one sowing. If this reasoning is sound, it would apply to the wheat and barley crops equally with oats; but no hoeing, either hand or horse, can be done to crops thus drilled.

Anyhow, the piece of oats we saw was certainly most excellent; the straw, shortened by the drought, would probably stand, and the yield of grain prove very large.

Harvesting is let to his labourers, 12 in number, with 3 or 4 lads to assist. Mr. Learner provides horses and reaping-machines, and they find all the labour, to cut, bind, stook, carry, stack, and thatch the whole of the crops, receiving 6*l.* per man for the job. Cutting proceeds at the rate of from 16 to 17 acres per day, three relays of horses being used; and with average weather the whole is completed in about fifteen days. The cost per acre, exclusive of horses and machine, averages 12*s.* 6*d.*

Threshing.—This is done by contract; the machine-owner providing engine and threshing-machine with two attendants, for which he is allowed 5*s.* per day in lieu of board, and is paid at the rate of 7*s.* per 20 coombs threshed; 120 coombs is considered a fair day's work. Hirer provides other necessary labour to take away straw, &c.

Working Staff consists of 1 yardman, 3 teamsmen, 6 ordinary labourers, 2 boys, 1 groom; with extra for harvest, 2 men and 2 or 3 boys. The labour bill for 1885, which may be taken as an average year, amounted to 27*s.* 2*d.* per acre.

Live Stock.

Cattle.—None are bred on the farm, but about 150 are annually bought and fattened on it. These are a good class of large-framed Shorthorn bullocks, attaining when fat to weights of from 65 to 80 stones of 14 lbs. The weight of beef produced on the

farm yearly we estimated at over 2000 stones. This, with the number of cattle turned over, may seem large for the acreage, and no doubt it is; but when we consider the great crops of roots grown, the liberal allowance of cake given, and that rarely any bullocks but those of mature age and forward condition are bought, the first impression, perhaps a little incredulous, tones down.

At our first visit we found 79 head of cattle, 52 of which were in various stages of ripeness. Some had then been sold in advance for Christmas beef at 9*s.* 2*d.* per stone, to weigh when slaughtered at Norwich. A similar class of animals at Christmas 1884 were sold in the same way, but at 10*s.* 6*d.* per stone. Mr. Learner disposes of many of his bullocks to local butchers by weight, attending personally or by deputy at the scales to see justice done. Referring to the lot of 52, we were subsequently informed that they averaged a little over 80 stones, making in cash 37*l.* each, and that they cost in the April previous 20*l.* 10*s.*, leaving 16*l.* 10*s.* each for six months' keep.

At our May visit we found in the yards	37	fat bullocks.
do. in pastures	75	three-year-old do.
do. do.	10	two-year-old do.
Total . .	122	

It was evident, however, that a number of these were only birds of passage, and probably resting there for a few days previous to removal to a marsh farm occupied by Mr. Learner in the Lynn neighbourhood.

In July we found 40 head of very fine bullocks in the pastures, getting from 8 to 9 lbs. of mixed cotton- and linseed-cake per head per day,—the whole fast approaching maturity for the shambles.

As already intimated, Mr. Learner is most lavish in the use of cake for stock-feeding, giving as much as 14 lbs. per day to his big bullocks while on roots in the yards. The latter he gives neat, that is, without admixture, and not in homœopathic doses, but as many as they can consume. Slicing is done, not with a turnip-cutting machine, but by the hand with a sickle, he considering that they can be cut better and quicker in this way than by machine, and any one witnessing the operation as performed by his men would come to the same conclusion. Men unaccustomed to the work would cut a sorry figure at it, and the practice is probably not destined to spread. His method of breaking cake for cattle is also primitive, being done with a hammer, and into pieces about four inches square. This he prefers to

having it reduced smaller by a crusher. For sheep he crushes to the usual size by machine.

Sheep.—At our November visit, 100 hoggets, a cross between the Down ewe and Longwool ram, were running on the clover layers, having turnips thrown down to them, and eating besides 1 lb. of cake each per day. These had been purchased in June. None were bred on the farm; and all had been caked throughout the summer; some of them were fit for market, and by the end of December they had all gone. In May no sheep were on the farm, but in June 200 lambs had been purchased, shortly before our visit; they were an excellent lot, and bred in the same way as those above described, and would be similarly treated and sold fat after six months' sojourn, weighing, Mr. Learner estimated, from 21 to 22 lbs. per quarter. Certainly a big weight for lambs of that age.

Cart Horses.—Twelve are kept to work the farm, of a good useful stamp, doing no discredit to the other excellent stock on it. A foal or two are annually bred, a mare being the only breeding quadruped tolerated on the farm. The feeding of the horses is peculiar; as Dr. Johnson's famous description of the use of oats* does not apply here. Four stones of pollard per week, with one stone per day of clover-hay is the allowance per horse. The hay is given uncut, but the horses have wheat-chaff and also a mangold or two per day in addition. The pollard per horse costs 2*s.* 6*d.* per week, and the hay, valued at consuming value, another 2*s.* 6*d.*, and with 1*s.* added for chaff and mangolds, makes up a very economical feed at 6*s.* per week. On this the horses evidently thrive, being full of condition and fit for work The free easy-working nature of the soil must, however, be taken into account.

Pigs.—None are bred; from 60 to 70 are bought during the year at 16*s.* to 18*s.* each. They are run in the bullock-yards, getting a little meal twice a day, and are sold again as stores, when worth about 42*s.* each.

Fences.—These are kept in beautiful order, sufficiently high and wide to be efficient without overshadowing or covering more ground than is necessary. They are trimmed yearly, and are neat and good in every respect. The hedge-banks are dressed down before the weeds, which to a certain extent maintain a footing there, and shed their seed. This year a start had been made early in July, but a halt was called in consequence of several unhatched partridge nests of eggs being found—the tenant having the shooting over the farm.

The foregoing details will give a fair idea of what is the

---

* Oats were used to feed horses in England, and *men* in Scotland.

practice on Burgh Farm, and the results achieved by it we will now briefly glance at. And first the *Root-crops*. *Mangolds*, about 15 acres, one piece of which was not quite so close a plant in some places as could be desired, but the other most excellent and very forward.

Swedes, and a few acres of white turnips, were all that could be wished for; a healthy vigorous plant, without any wants, over the whole of the 51 acres, and with every prospect of their attaining to large crops. Barring a little annual weed, which the hoe would readily eradicate, the whole of the land under roots might be pronounced perfectly clean. We could only, from what we saw of the crops last autumn, infer what the present ones are likely to attain to. The mangolds then were certainly not less than 35 tons per acre, and the swedes we put at 25 tons, and had no reason to suppose the weights this year would be less.

Wheat, of which there is 73 acres, is in keeping with nearly all we have seen this year, viz., had suffered from the untoward winter, and in some places was a little thin on the ground, but healthy and well headed, and looked like yielding not much short of 5 quarters per acre.

Of *Barley* there are 68 acres. A thick good plant all over. In early summer so gross was it, that flagging was resorted to in order to prevent its going down. The dry season, however, put a different face on the matter, greatly decreasing the anticipated bulk of straw; and in some few places, where the gravel is near the surface, the grain has also suffered, but not to such an extent as to materially affect the crop, and the better quality will more than make up for the slight deficit in quantity. The yield per acre over the whole we estimated at 5½ quarters.

Oats.—Seven acres, and, as already mentioned, they are likely to prove a large crop. We should not exaggerate in putting the yield at nearly 10 quarters per acre.

The corn-crops, as the roots, we found practically clean. A little red weed was observable in some of the barley, but not in quantity to do harm. Couch-grass was nowhere to be seen.

Sixty-four acres of clover were cut and stacked in good order before our final visit, and we did not see the crop; but in May it did not promise to be anything beyond ordinary.

Fertility is maintained less by patronising the artificial-manure maker than the cake merchant. One hundred tons of cake are purchased yearly, and passed through the big bullocks already described, the theoretical manurial value of which, according to our best authorities, being not less than 500*l.* But in addition, 100*l.* worth of Yarmouth town and artificial

manure is also brought on to the farm, together equal to an expenditure of 35*s.* per acre for manure over the whole.

The grass-land is also brought under this fertilising influence. None is ever mown, and the consumption on it of so large a quantity of cake must certainly tend to increase its power of production; and we are inclined to think that this practice of manuring by means of live-stock is the safest and most judicious that can be pursued. But in saying this we must not be understood as approving the use of so large a quantity of cake as Mr. Learner gives his cattle, although it is within the experience of the reporting judge, and doubtless could be confirmed by others who have fed animals for fat stock shows, that they will consume more than 14 lbs. of mixed cake and meal, and gain more weight than when having a less quantity. But it is highly probable that a part of such large quantity may pass through the animal without assimilation, and hence be wasteful. On the other hand, with high-pressure feeding, time is gained, and a saving effected at various points, so that as usual something may be said on both sides of the question.

It will, however, be obvious that the pecuniary success of a farm worked on the lines which I have described must largely depend on the manager's judgment of the grazing qualities of his cattle, and his capability as a market-man of dealing with them. I do not think we saw an inferior animal of any sort on this farm —a fact which indicates good judgment; and, as to the latter, it is said "experience maketh the simple wise," though we doubt if in any stage of his existence Mr. Learner could come under that category, and I cannot doubt that, with his immense experience in the trade, he could well by this time graduate in it as a Master of Arts.

Book-keeping is, perhaps, the weakest link in Mr. Learner's chain. The books kept are—a Day-book, showing all the outgoings for labour, rent, rates, and all other expenditure on the farm; a Stock-book, showing the cost of his cattle and sheep, the cake they consume, and the prices they are sold for; and a Corn-book, showing what his crops realise. He commenced life as the occupier of 150 acres, and now farms 1200—a fact speaking volumes as to his capacity as a profitable manager, while the preceding details show that the other conditions required of a successful competitor were amply fulfilled, and that Mr. Learner well merited the first prize in his Class, which we awarded to him.

We recommended the Council to grant a Certificate to Robert Flotman, who has been in Mr. Learner's employment for fifteen years, and previously for twenty-four years in the service of Mr. Burr, who owned and occupied the farm, and for the tenant

occupying before Mr. Burr he worked twenty years. In all he has been fifty-nine years on the farm, and is now eighty-three years of age, and is employed by Mr. Learner to do any odd job he can at 1*s.* per day.

From the South Erpingham Agricultural Association he obtained in 1870 a Certificate of Merit for long servitude and good conduct.

Class II.—Second Prize.

Mr. W. S. Procter, of Bexwell, Downham Market. Bracketed equal with Mr. S. R. Sherwood, of Hazlewood, Suffolk.

This farm is the property of John G. Morris, Esq., of Allerton Priory, Liverpool, and contains:—

	A.	R.	P.
Arable Land	256	2	0
Grass do.	120	2	0
Total	377	0	0

Mr. Procter has occupied the farm as yearly tenant since 1870, at a rent of 678*l.* per year; and rates, which he pays in addition, stand to a little over 3*s.* in the pound.

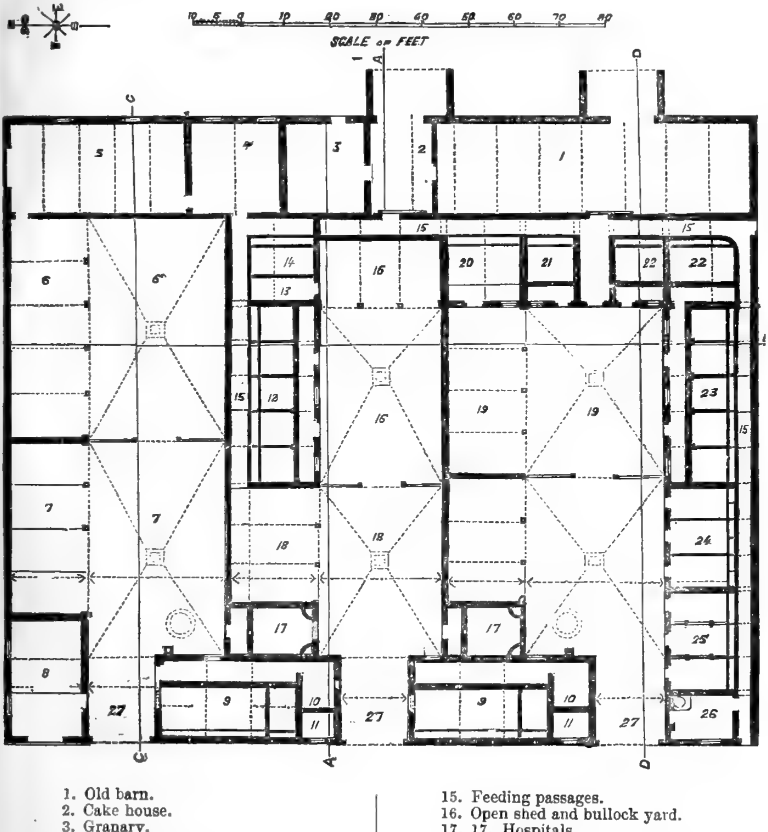
It is situated by the side of a highway, $1\frac{1}{4}$ miles east of the railway station and town of Downham Market. The dwelling-house is old, but in excellent order, and very comfortable. A small dairy attached has been fitted up recently in a very elaborate style by Mr. Morris. The floor is tiled; the lower tier of shelving stone-flag is $2\frac{1}{2}$ in. thick; the second tier is slate, $1\frac{1}{4}$ in. thick; while the third tier is wood.

The farm buildings are new, being erected by the owner in consonance with the ideas and wants of the tenants; indeed it may be said that from his brain the plan of arrangement emanated. They are built in a very substantial manner, all the fittings are good, and water is laid on to the stalls, boxes, &c., throughout; and liquid from the yards is drained to the tank outside. The general arrangement is very convenient; and as they are by far the best set of buildings we saw in our inspection, we considered a plan of them would be an acquisition to the Report, and by the courtesy of Mr. Morris I am enabled to give, not only the plan but sections of the buildings.

If I may venture to criticise at all, it would be that the root-house might have been more central, moving it and the mixing-room up to the old barn. I should also have liked to see a connecting passage to the stable, as shown by the

dotted line, through No. 18; but notwithstanding these, the buildings are very capital ones. I here insert plan and particulars of them.

Fig. 4.—*Plan of Mr. Procter's Farm Buildings.*



1. Old barn.
2. Cake house.
3. Granary.
4. Chaff-mixing room.
5. Turnip house.
6. Open shed and yard for store beasts.
7. 7. Open shed and yard for horses.
8. Chaff house.
9. 9. Stables.
10. 10. Harness rooms.
11. 11. Chaff bins.
12. Fat beast stalls.
13. Passage.
14. Box for fat beast.
15. Feeding passages.
16. Open shed and bullock yard.
17. 17. Hospitals.
18. Open shed and yard for young horses.
19. Open shed and yard for cows.
20. Bull box.
21. Loose box.
22. 22. Loose box for cows.
23. Cow house.
24. Calf house.
25. Pigs.
26. Boiler house.
27. Entrance gateway.

Soils, Labour, Purchased Manures and Cakes.—The soil varies from a free working mixed one to a clay loam, the former preponderating, and nowhere on the farm can very poor land be

said to exist. This may be gathered from the comparatively small outlay in cakes and purchased manures, together with the fact that the crops were uniformly good; about 100*l.* per year is spent in cakes, and 45*l.* in manure. The rent, within a fraction of 36*s.* per acre, also betokens a farm of character. The subsoil

Fig. 5.—*Section through the line* A A.

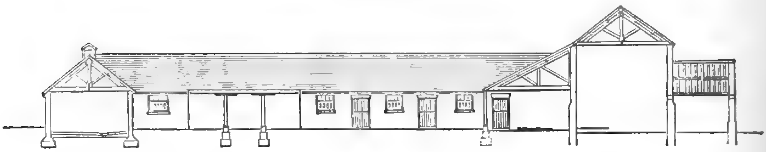


Fig. 6.—*Section through the line* B B.

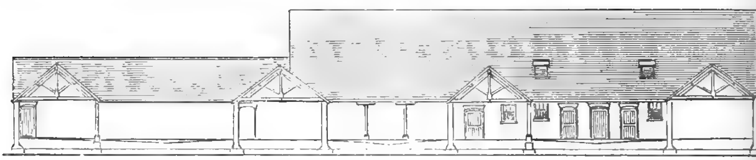


Fig. 7.—*Section through the line* C C.

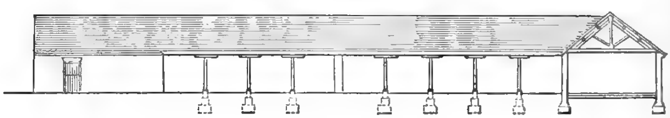
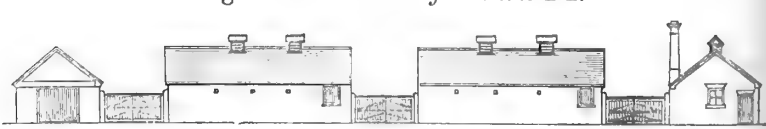


Fig. 8.—*Section through the line* D D.

Fig. 9.—*Section through the line* E E.



is clay, sand, and some peat. All the land that required it has been drained at the joint expense of owner and occupier, the former finding tiles, the latter labour. On draining, as on all other matters connected with his calling, Mr. Procter's ideas

are practical, and therefore worth recording. He has had it done by the day, closely watching the work, thinking that, of all work on a farm, under-drains require most attention. He has taken up drains laid by his predecessor, one foot deeper in some places than others, with the consequence of sediment settling in the lower places and stopping the drains. As regards depth on porous and springy land, they cannot, he thinks, be laid too deep in reason, in order to keep the springs as low as possible. But on strong tenacious clay he thinks that drains may be laid too deep, for in wet weather the land becomes so tough that the water cannot percolate through it. On this land they should be laid closer and "fleeter" than has been the custom in some parts. If it is only surface water, why drain it down so deep? What we want is to get the water off the land as quickly as possible, in order to give warmth to it. But if it is locked in, in sand or gravel beds, by gault or clay, "then I say cut deeply through the clay, sand or gravel in one uniform depth, to tap those beds and draw the water off."

Rotation of Crops and Management of Arable Land.—The rotation of cropping on the farm is the usual four-course one, but half of the land in course for clover is sown with peas, and sometimes a few beans, the cropping being thus:—

$\frac{1}{4}$ in wheat,
$\frac{1}{4}$ in roots,
$\frac{1}{4}$ in barley,
$\frac{1}{8}$ in clover,
$\frac{1}{8}$ in peas.

Mr. Procter's reason for this deviation is that clover does not succeed with him if grown more frequently than once in eight years on the same land. He has tried all kinds, and everything fails except rye-grass, but that he does not like. A bad clover crop means a succeeding bad wheat crop, and therefore he interpolates the peas, by which means he secures excellent crops of red clover, with wheat crops correspondingly good, and is of opinion that this practice gets him as much clover, and much more wheat, with the pea crop given in, than some of his neighbours get from the same acreage who alternate their grain crops with clover layer only. His clover crop this year was certainly a very fine one; at our May visit the plant was excellent and forward, and in July was secured as hay in a very large rick, while the prospect for a second crop was the best we saw on any of the farms inspected. It is the power to discern and act on matters such as this that renders one man a success on a farm where another is a failure.

Farmyard-manure is applied for wheat on the clover layers

and pea stubble, which are ploughed and treated in the usual way, and 8 pecks of seed are sown per acre.

For the root crop, the first preparation is to clear the land between harvest and Michaelmas of any weeds that may be in it, Mr. Procter believing that immediately after harvest is the best of all times to accomplish this economically and successfully. When this is done, 10 or 12 loads of farmyard-manure are carted on the land intended for mangolds, and ploughed deeply in. In spring another furrow is given, other cultivation following until the land is got into proper tilth, when, 4 cwt. of artificial manure having been sown broadcast, it is closed into ridges, and drilled with 7 lbs. of seed per acre.

Swedes and white turnips are treated in a similar way, except that no yard manure is given for them, but 4 cwt. of Lawes's turnip manure is sown over the land and ridged in as for mangolds. Swede seed is sown at the rate of 3 pints per acre.

One half of the swede and turnip crops is drawn off, and the other consumed on the land by sheep eating 1 lb. of cake or beans, which leaves the land in good condition for the following corn crop—barley—the seeding for which is 3 bushels.

Peas, which are sown on half the land after barley, get no manure ; but when a few acres of beans are substituted for peas, a dressing of farmyard-dung is given, being spread on the stubble and ploughed in.

The whole of the corn crops were good, and looked like yielding grain abundant in quantity and good in quality. The peas—23 acres—were also a very good crop.

At our May visit the field for mangolds, one of the stiffest on the farm, was ploughed ; but rain was wanted before a sufficient tilth could be had. The plant in July was patchy and the least satisfactory of any crop on the farm.

The swedes and white turnips were a splendid plant, the latter having been sown for early feed and thinned. All the swedes were ready for thinning ; some of them we thought ought to have been thinned ; but Mr. Procter considering otherwise, intended leaving them until rain fell, or the rays of the then extremely hot burning sun were obscured by cloudy weather, the former occurring on the evening of our visit.

All the crops were clean, couch grass was very scarce, and annual weeds few.

The fences were not all good, the outside ones not much to complain of ; but those internal, especially bounding the grass-land, were old, and thin at bottom. The banks of all were untrimmed in July ; but this delay arose on account of the partridge nests, which would have been destroyed had the work proceeded earlier. This gave an untidy appearance to the

fields, and the more so that here and there docks were to be seen on them. These, perhaps, cannot be wondered at, considering the great difficulty there is in eradicating docks when once they get established; and it may be imagined to what extent they had overrun Bexwell Farm, at Mr. Procter's entry, when we mention that he offered 50*s.* an acre in vain to his labourers to dock a field,—a process which ultimately cost him 5*l.* an acre.

Mr. Procter keeps no books, at least they were not forthcoming; but he gives the impression of being far too shrewd a man of business not to have some method of his own to record his business transactions and enable him to see how he stands.

Labour.—The yearly sum paid for labour runs to about 560*l.*, averaging per acre over the whole farm 1*l.* 9*s.* 8*d.*

Grass-land.—The greater part of the grass-land is very good, and certainly is not deteriorating in Mr. Procter's hands, both cattle and sheep eating cake on it. The meadow-land is dressed with farmyard-manure every alternate year. He has a great horror of mowing pasture-land; his predecessor on the farm mowed a fattening pasture, with so deteriorating an effect that five or six years of heavy cake-feeding barely restored it to its pristine power of growth and condition.

Live-Stock.

Cattle.—In the matter of cattle supply the system adopted may be described as a self-supporting one, calves being reared yearly equal in number to the fat cattle sold off. Ten good non-pedigree Shorthorn milk-cows and a pure bred pedigree bull are kept, which usually produce every year 10 calves; 15 to 18 more being bought; while 25 bullocks and heifers, and 2 or 3 fat cows are sold off fat. As a rule, from 90 to 100 head of various ages are on the farm. In November we found 97; in May, 95; in July, 96. They are sold at ages varying from 2½ to 3 years old, one lot going at Christmas, another towards May, but sometimes a few are kept until July.

Until the fall in the price of beef these cattle gave a return at the rate of 1*l.* per month, dating from birth until sold to the butcher.

The mode of rearing calves is as follows. From a fortnight to three weeks after birth they have new milk, and then milk twelve hours old, with the cream removed, for two or three weeks longer. After that they get what old milk there is to spare, supplemented with linseed-gruel. They are kept in the yards the first year, getting green food in summer, and a mixture of cut hay and straw with roots during the winter. They are put

on to concentrated food as early as they will take to it, the mixture being bran, ground oats, linseed-cake, and bean-meal. Mr. Procter decidedly prefers the use of a large proportion of the latter, his experience being that it invariably stops scour, and acts as a preventive against it.

The management of cattle—as indeed every department of this farm—is carried out in a careful and systematic manner. Animals are never allowed to lapse in condition, but steady progression goes on from the beginning to the end.

The Dairy is under the direct superintendence of Mrs. Procter, and for order and cleanliness is a model. The milk is kept in earthenware bowls, which in summer are placed on the stone and slate benches previously referred to, and in winter on the wooden ones. The chief product is butter, which finds a ready market at Downham.

Sheep.—Sheep are not bred on the farm, but from 250 to 300 lambs, a cross between Down ewes and Long-woolled rams, are bought in July, and gradually grown and fatted off within the year. When on turnips in winter they have as much chaff as they can consume, with 1 lb. each per day of old beans, peas, or cake, according to the weather, Mr. Procter preferring the former when it is wet and cold.

During the earlier years of his occupancy he sustained great loss from lambs being attacked with and dying from diarrhœa, as many as twenty per week dropping off. This he found arose from placing them on land that had recently been folded or depastured with sheep. He changed his practice in this matter, and ran them in fields where cattle only during the season had been grazed, and with most satisfactory results, losing none from this cause in late years.

Horses.—Twelve horses are kept to work the farm, strong useful animals of the Shire breed. Two mares are put annually to the horse to maintain the number, and this practice also admits of the sale of a good colt or two occasionally.

There is nothing in their feed or management that calls for special note. They are fed in the stable and afterwards turned into the yards for the night.

The number on the farm at our last visit comprised 12 horses in work, 1 brood mare and foal, 2 two-year-old fillies, and 2 yearlings.

Pigs.—At one time Mr. Procter fattened a great many pigs, but gave it up when the price of pork got under 6*d.* per lb., considering that it did not pay him to feed at less than that price. His practice now is to breed from 60 to 70 yearly, and sell them as strong stores at about 40*s.* each; the receipts average 150*l.* per year. All the litter and manure are entirely removed

weekly from his piggeries, and the floors are well swilled with water, and the walls washed down and so kept clean and sweet.

Weather permitting, the pigs have a daily run on grass in a paddock adjoining the buildings. At our last visit he had in stock :—

7 sows,
1 boar,
1 fattening pig,
23 stores,
—
32

No books were presented to us, and therefore we could not verify on which side of the farm account the balance preponderated; but taking into consideration the good crops, the satisfactory management of live-stock of all descriptions, together with the thrifty, careful husbandry which appeared in every branch, and evidenced by the moderate outgoings for labour, manure, &c., we should, we think, not be very far wide of the mark in hazarding an opinion that the receipts had it, and very decidedly.

Farm Servants.—Our enquiries in connection with awarding certificates of merit to the servants of the competitors, led Mr. Procter to favour us with an idea he has of the practicability of establishing a sliding scale of wages, based on the price of wheat, which he thinks would be equitable to employers and employed, and tend to prevent ill-feeling and strikes, which, though less common in the agricultural than the manufacturing community, are not unknown in the Eastern Counties. As a basis, he assumes that when wheat ranges in price from 12*s.* 6*d.* to 15*s.* per coomb of 4 bushels, the labourer's wage should be 10*s.* per week; when from 15*s.* to 17*s.* 6*d.* per coomb, the wage should be 11*s.* per week; when from 17*s.* 6*d.* to 20*s.*, the wage should be 12*s.* per week; and so on up to 30*s.* per coomb, when the wage should be 16*s.* per week.

We recommended the Council to grant certificates to two men employed by Mr. Procter. One of them, James Groom, is a very extraordinary man; though now in his eighty-third year, he is yet able-bodied, does his full share of work, and is paid the same wages as other men on the farm, and shows temper if he thinks there is any disposition or attempt to ease him a little. He has been seventy years on the Bexwell Farm, and had certificates from the West Norfolk Association in 1856–57–58 for general good character, and for

bringing up the largest family with the least assistance. The other man, Isaac Fincham, has been on the farm for fifty years as general labourer, and was recommended by his employer as an excellent servant, and has brought up a large and respectable family. He is now in the seventy-sixth year of his age, and is able to earn 8*s.* per week as wages.

Class II.—Second Prize.

Mr. Samuel R. Sherwood, Hazelwood, Friston, Saxmundham, Suffolk. Bracketed equal with Mr. Procter, of Bexwell.

This farm, which has changed hands since the entry for competition was made, is now the property of T. Vernon Wentworth, Esq., Yorkshire. In extent there is of—

Arable land	269	acres.
Grass do.	87	„
Sheep-run, Gorse	95	„
Saltings and Reed	10	„
Total	461	„

Mr. Sherwood's occupation commenced at Michaelmas 1881, and he holds it as a yearly tenant, paying a rent of 300*l.*, tithe rent-charge of 45*l.*, and rates of 34*l.* per year. Total for rent, tithe, and taxes, 379*l.*

His agreement contains no restrictive clauses as to cropping or sales, but he usually crops on the four-course rotation.

It is situated in that corner of the county which was known as the "Sandlings" in Arthur Young's time, the greatest part of the arable being a mixed sandy soil, resting on a sandy subsoil, a little clay occurring at the extreme west end of the farm. The grass-land skirts the river Alde, from the overflow of which it is protected by an embankment, with a sluice at the lowest point to let off the water accumulating on the land side. The soil here is alluvial, and affords good pasturage for sheep and for carrying on bullocks.

The 95 acres described as a sheep-run is a worthless sand, to a great extent covered with gorse, affording excellent harbour for rabbits, which abound; it is turned to account as a stray for the ewes.

The dwelling-house and neatly-kept garden, with farm buildings behind, abut on the highway running from Saxmundham to Aldeburgh, and are nearly in the centre of the farm. The chief

part of the arable land being in the rear, with the sheep-run and grass-land extending to the river in front.

As will be surmised from the nature of the soil, success greatly depends on the season, such a drought as was experienced this summer up to the middle of July affects it most disastrously, greatly reducing the yield and value of the corn crops, and quite burning up the layers on the thinner soil.

The management is skilful, energetic, liberal, and successful, and reflects great credit on the occupier.

The yearly outlay for cakes purchased averages 356*l.*, and for artificial manures 100*l.* The labour bill has averaged 578*l.* yearly, which, leaving out the sheep-run, stands to 32*s.* per acre. This is an undoubtedly high sum for soil so easy to work. Mr. Sherwood explained that an excess was caused by re-building most of the farm premises and two new cottages during his tenancy, besides cartage of material for road-making, he at his own cost carting all required. Also, that the land east of the house is too poor to grow hedges, involving a considerable sum yearly in making up dead fences, and that the stells on the riverside land required yearly scouring, all of which add to the expense, but are not incident to an ordinary farm.

At our first visit in November we found the mangolds all clamped and covered with bracken, but not soiled; and we had an opportunity of seeing some very large roots of good quality. The crop had been awarded the first prize for the best field of mangolds, 14 acres, offered by the Framlingham Farmers' Club; the Judges ascertained the weight per acre, topped and cleaned, to be 35½ tons. They had also awarded the first prize for the best field of swedes, 11 acres, to Mr. Sherwood, ascertaining the weight per acre, topped and cleaned, to be 22½ tons. The swedes were then in the field and looked a fine crop, as were also a crop of white turnips, which we thought small; but they, being intended as spring feed for his ewes, Mr. Sherwood said that they suited his purpose as well as a bulkier crop, which would not stand the winter so well, and would be less nutritious when wanted in the spring.

The live-stock on the farm then comprised—

300 ewes,
40 fatting bullocks,
4 cows,
20 fatting pigs,
14 horses,
2 colts.

At our second visit 449 lambs had been bred, with a loss of 4 ewes.

The 40 bullocks had been fatted and sold; other 19, nearly fat, were in the yards on roots and cake, and 110 fatting sheep were on the marsh-land getting cake also.

In July the 19 bullocks had gone, and 24 for grazing had been bought and were running on the pastures. The fatting sheep had also been disposed of, and the only sheep then on the farm were the 296 ewes and 449 lambs. The dairy stock had increased by a couple of calves, and the horses by the birth of a foal.

As a rule, about 60 bullocks are bought and fattened, chiefly on roots in the yards; but a few are run over the marshes in summer and finished off on roots. Hoggets to fatten on roots are also bought in the autumn, the number depending on the crops; but they average about 100, and more are bought in April to fatten on grass.

The chief sheep stock are the ewes, 300 of which are annually put to the ram; the breed is the old Black-faced Suffolk Down. The small percentage of loss in ewes, and the large fall of lambs prove the excellent management of the flock. The first prize offered by the Suffolk Agricultural Society for the largest crop of lambs, with the least loss of ewes, was this year gained by Mr. Sherwood's shepherd.

The following are the lamb statistics for the four years that Mr. Sherwood has occupied the farm.

In 1883	for every	20	ewes put to ram	he reared	24	lambs, sold at	49*s*. 6*d*.	each.
,, 1884	,,	20	,,	,,	25	,,	31*s*. 6*d*.	,,
,, 1885	,,	20	,,	,,	25	,,	26*s*. 9*d*.	,,
,, 1886	,,	20	,,	,,	30	,,	25*s*. 6*d*.	,,

The routine of flock management is as follows, viz., the rams, six in number, are put to the ewes in October, the keep at that time being colewort, cabbages, or turnips, with a run on the grass. After the rams are removed, and until lambing commences, they run on the grass, getting besides a few white turnips, with a little cake or malt coombs as the time approaches. During the period of lambing, white turnips and thousand-headed kale form their staple food, from which they are removed to the clover layer and early rye as soon as they are ready for feeding.

The lambs are weaned in July, and all sold direct from the ewes. Shearlings are bought yearly to fill up the drafts of the crones, light ewes, or those that have in any way gone amiss. This is considered better policy than rearing the ewe-lambs bred on the farm, although big prices are given yearly for them. More are bought than is required to fill the gap, conferring the power of selection, and those cast out are fattened.

On the removal of their lambs the ewes are turned on to the walk, and from there to the grass and cole as rutting time approaches.

As the foregoing figures show, the hoofs of Mr. Sherwood's sheep, if not golden, at least carry animals conspicuous as gold winners; and the most is made of the land in course for green crops for their sustenance.

Rye, trifolium, &c., are sown in the autumn on the stubbles where the soil is weakest, and then fed off in spring and early summer, crops of white turnips, cole, &c., following, and these again fed off as a preparation for barley.

Large crops of swedes and mangolds are by heavy dressings of manure grown on the better soils, and their consumption with cake and corn creates a fertility producing good corn crops, on land naturally poor, and which, under treatment less liberal, would speedily revert to comparative barrenness.

For mangolds, 20 loads of farmyard-manure and 4 cwt. of artificial manure are applied, and 6 lbs. of seed drilled on the flat.

For swedes, 10 loads of farmyard and 4 cwt. of artificial manure are given, also sown on the flat with 3 lbs. of seed.

As will be seen, Mr. Sherwood's practice with regard to the application of manure differs from what is the rule in Suffolk and Norfolk, he applying dung for the root crops instead of to the wheat. For the latter, after layers, he applies 4 cwt. of rape-cake with the seed, and 1 cwt. of nitrate of soda in the spring; the seed sown being 2 bushels per acre.

Barley after roots folded with sheep requires no manure; the seed per acre is 2 bushels.

Beans, of which he has this year 12 acres, sown in the autumn, after barley on the piece of good-bodied land underlain by clay, were manured with foldyard-manure, 12 loads per acre; the seed is 2 bushels per acre.

Peas, also after barley, are manured with 10 loads of yard-manure and 2 cwt. of artificial.

At our May visit the whole of the barley looked remarkably promising. Two fields of wheat were very good; but another piece had suffered so much by the severe winter that it was considered advisable to drill oats amongst it. The field of winter beans was also looking well, but the peas were thin. The mangolds had been sown, and preparations were going on for swede sowing.

On our return in July we found the whole of the barley crop dwarfed by the drought, and in several places much burnt up. The mixed wheat and oats was not a satisfactory crop, but the remainder of the wheat was good; one field very good.

The peas were still thin, but the beans were thick on the ground, fair in length, well podded, and a very superior crop.

The roots on the whole were promising for good crops, one piece of swedes was very excellent. The land on which the spring green crops had been grown, and which had been folded with sheep, was being broken up and prepared for white turnips, cole, &c.

Except some annual weeds among the peas and colewort the land was very clean, which we considered reflected much credit on Mr. Sherwood's energy and industry, as the farm was known to be in a very foul state on his entry in the autumn of 1881.

As already mentioned, the farm premises had to a great extent been renewed after Mr. Sherwood's entry, but there is not much in connection with them calling for remark. The cattle are accommodated in roomy open yards with ample shelter sheds; while a large barn, not a recent erection, provides needful room for corn and cake stores, chaff-cutter, &c.

The cottage accommodation is good, four cottages having been on the farm at Mr. Sherwood's entry, and two others have since been built by the owner; indeed, they were not quite finished in July. The latter are commodious—two rooms, with pantry, brick oven, &c., on the ground floor, and three bedrooms over.

The fences are fairly well kept. On that part of the farm extending west from the house they are thorn, but on the eastern side the soil is too poor to grow that plant, and they are dead fences, made with furze and thorn, but kept in very good order. As already mentioned, the labour involved in keeping them up must be something considerable, and add seriously to the annual outgoings of the farm.

Book-keeping is not one of Mr. Sherwood's strong points; memoranda he has no doubt sufficient for his purpose, but systematic book-keeping he has not hitherto aspired to.

Class II.—Commended.

Mr. Edwin S. Durrant, Wimbolsham, Downham Market.

Arable	342	acres.
Grass	134	,,
Total	476	,,

This farm is situated one mile north of Downham Market, and is separated by the highway from the second-prize farm

occupied by Mr. W. Procter. It is the property of two owners, Thos. L. Hare, Esq., of Stow Hall, Downham Market, owning 442 acres; the remainder—34 acres—being glebe land, belonging to the Rev. J. H. Clubbe, of Bexwell. It is held under a fourteen years' lease, which expires at Michaelmas 1888; but Mr. Durrant occupied it for twelve years on a previous lease, so that he has now been tenant for about twenty-four years. The rent from 1862 to 1882 was 700*l.* per year, but at the latter date it was reduced 20 per cent., and it now stands at 560*l.*; in addition the tenant pays the tithe-rent charge, 92*l.* per year. Rates average about 2*s.* 6*d.* in the pound per year.

On Mr. Hare's land the lease stipulates a four, five, or six course shift of cropping; but as a rule Mr. Durrant finds little benefit in departing from the old four-course system, and seldom avails himself of the liberty he has to sell produce off the farm other than corn.

The principal farm buildings stand rather inconveniently at the west end of the arable portion of the farm. They are old, and the arrangements as regards convenience not particularly good. An off-yard, consisting of a barn, with yard and shelter-shed, &c., is situated pretty centrally on the farm, where there is also a labourer's cottage. The dwelling-house, large and good, is comparatively new, situated pleasantly in well-furnished and well-kept grounds, and affords all the conveniences essential to the habits and requirements of a gentleman of education and refinement.

Purchased Cakes and Manures.—An outlay of 320*l.* per annum is made for cakes, malt, and bran for cattle feeding, and for barley and peas for pigs. For artificial manure 120*l.* per year is spent.

The labour per acre over the whole 476 acres averages 33*s.* per year.

Draining, when necessary, has been done at the joint cost of landlord and tenant, the former providing tiles, the latter labour. The cost of the latter per rod of 7 yards, at 3 feet deep, was 9*d.*

A small dairy herd is kept, principally of well-bred pedigree Shorthorns. From 15 to 20 calves are reared annually. Occasionally young bulls and heifers are sold at remunerative prices for breeding purposes. The remainder—due provision being made for the maintenance of the number of the herd—go to the butcher. From 30 to 40 head are generally fattened, store cattle being purchased to add to the number of those home bred. In July we saw some very nice two-year-old Shorthorn heifers in the pasture, and also several very fine fat bullocks in the yards. The chief dairy produce is butter.

In May the following head of cattle were on the farm :—

Cows, in-calf or in-milk	17
Calves under one year	22
Heifers under two years	7
Bullocks under two years	25
Bullocks, fatting	8
Heifers, fatting	4
Bulls	2
Total	85

Sheep.—A breeding flock of 100 half-bred ewes are kept, and crossed with Oxford Down rams, the produce being fattened and sold at thirteen and fourteen months old. At our first inspection the ewes were on the farm, but we did not see them on our subsequent visits. Mr. Durrant, like several other of the competitors, occupies another farm besides this entry, and they were probably there. Besides those bred on the farm, other sheep are bought, varying in number according to the prospects of keep,—lambs for the layers in summer, and shearlings generally for roots on the strong land in winter.

In November we saw on the farm—

Hoggets	180
Shearlings	90
Ewes	100
Total	370

In May the only sheep we saw were 570 fat and fatting hoggets, several of which Mr. Durrant stated he had recently purchased. He cakes more or less nearly all the year round, as the heavy cake bill already mentioned indicates.

Horses.—Sixteen cart-horses are employed in the work of the farm, and we also saw a very good Shire-bred cart stallion, with points featuring the Clydesdale, which one of the Judges fancied so much, that at our May visit a bargain was struck, and he was transferred to the banks of the Tweed.

Mr. Durrant's horses are turned into the yards at night, and he holds the opinion that they have fewer ailments when so treated, than they would if always kept in the stable.

Nearly all the grass-land is grazed, one field only usually mown. The most of it is only moderate in quality; the best piece—20 acres—is used for the animals most forward for market, which are caked on it.

Arable Land.—The soil as to one part is a heavy loam, on a marly clay subsoil, which required draining, and therefore has

been drained. The other part is a light soil, some portions very light, and the rest are on a sandy subsoil.

The heavy land is cultivated on a 9-feet stretch, so common on the heavy land in the Eastern Counties.

Farmyard-manure is applied for wheat and mangolds, Lawes's turnip-manure, 5 cwt. per acre, being the dressing given for the swede crop.

The corn crops varied much; some of the wheat was very good, and some very indifferent; the same remark applied to the barley, one field being as good as anything we saw in our inspection. The beans, 10 acres, were short, but fairly well podded. They succeeded wheat, with ten loads of farmyard-manure as nutrition per acre.

Ten acres of mangolds were good, another 10 acres were short of plant, and the swede plant was fairly good. Taking the arable land as a whole, it was not so free from weeds as some of the farms in the Class. We must not, however, be understood as insinuating that Mr. Durrant's farm is foul, for that it is not; but it is in some measure less clean than those of his opponents to which we awarded prizes.

The fences are extremely good, and display great skill and care in their management. If a prize had been offered for the neatest and best fences, Mr. Durrant would have been to the fore. On his entry to the farm he re-arranged several of his fields, stubbing old crooked fences and planting new straight ones, which must have cost a very considerable sum; but the details and amount he did not supply to us, and therefore we cannot give them.

The farm accounts are kept in a businesslike way in cash-book and ledger.

Class II.—Commended.

Mr. Henry Smith, Great Melton, Wymondham, Norfolk.

Arable Land	.. ..	228 acres.
Grass „	.. ..	146 „
Total	.. ..	374 „

This farm, which is situated four miles from Wymondham, is the property of the Rev. H. Evans Lombe, of Bylaugh Park, East Dereham, and is held on a yearly tenancy at a rent of 465*l.*, the tenant also paying a yearly tithe rent-charge of 120*l.* Rates average about 50*l.* yearly. He has occupied it for fifteen years, succeeding his father-in-law, who occupied it for forty years previously. The highway from Norwich by way of Kimberley

to Hingham intersects the farm, affording convenient access to much of it. The lawn in front of the farmhouse with adjoining garden is very nicely kept, but the house and also the farm buildings are very primitive (the date on the walls of the former being 1627), and also in a bad state of repair. The farm is a very desirable one; and judging from its immunity from weeds and general management, we should also so designate the tenant.

The chief part of the surface soil is what is known in Norfolk as a "mixed soil," a term synonymous with a friable loam, but some of the fields approach a heavy or clay loam. Nearly the whole rests on the Boulder clay. Old clay pits abound on the farm, showing that in former times their contents must have been extensively used as a top dressing.

The rotation of cropping followed is a four-course one, and the practice as regards manuring, &c., is so much the same as on those farms in this Class which we have already described, that to detail it would be a needless repetition. Perhaps the chief variation worth notice is the application of a part of the farmyard-manure to the swedes, instead of using it all for the wheat, beans, and mangold crops. This year Mr. Smith has 40 acres under swedes, 24 of which had 14 loads of farmyard-manure per acre, and 16 received 5 cwts. per acre of bone superphosphate. This practice must necessitate smaller dressings of farmyard-manure for the wheat, but compensation is given in the form of nitrate of soda and salt, sown in the spring, at the rate of 6 stones of the former and 12 stones of the latter per acre.

In November a very fine field of young clover was noted, 1 peck of clover and 1 peck of Italian rye-grass having been the liberal seeding for it. The root crops were excellent, and were being consumed by 10 fatting cattle and 29 two-year-olds in the yards, while 511 sheep, chiefly hoggets, were folded over them in the fields. One lot was penned on mangolds, a practice rather uncommon, indeed we had never seen it done before. Mr. Smith remarked that it enormously economised haulage. This was evident enough, but whether the consumption of mangolds at a date so early is economical, or a practice to be recommended, is a question on which opinions may vary.

At our visit in May we found 600 hoggets fatting on the grass-land, these had been bought for the purpose; the sheep we saw in November had been fattened and sold.

Milch cows numbered three, but there were no grazing cattle. Carthorses were 10, and mares, foals, and colts one and two years old, in number 8. With regard to young horses, Mr. Smith states that he takes up and "gentles" all his colts at two years old, and at the following Michaelmas they work well,

being of course well kept the previous winter. He keeps no mares specially for breeding, but covers all his fillies, cart and nag, at two years old.

Pigs, 13 stores. None are bred on the farm, but a few are bought to consume the offal, and 4 or 5 are fattened out for home consumption.

The following are the notes, abbreviated, which we made in walking over the farm in May.

"Land sown with and in preparation for roots, very clean indeed, free from couch, and little sign of annual weeds. All the barley very promising—vigorous plant and plenty of it, colour good, and free from weeds. Wheat after beans, thin and some weeds; wheat after clover, vigorous and good colour, but somewhat wanting in plant, one field particularly good, decidedly the best plant we had seen in our inspection. A field of clover and rye-grass, an excellent piece, as good as any, if not the best, we had seen. Winter beans very short, not likely to come to much."

In July the following live-stock were on the farm:—

Two-year-old bullocks—Irish	40
Lambs	240
Horses as before.	

The fatting sheep grazing in May had been disposed of, and the bullocks and lambs above-mentioned had been purchased.

The barley crops were good, had been shortened in straw by the drought, but the yield would doubtless be satisfactory. The wheat after beans was still a trifle thin, but well headed and would yield well; that on the clover layer was very good for the year; while the piece that looked so well in May had grown to a magnificent crop. The seed was Webb's "Kinver Giant," evidently a long-strawed variety; but the heads were also a great length, though rather loosely set, and the plant as thick on the ground as a wheat crop well could be. It was the bulkiest piece we had seen.

For anything stunted in May the season was not recuperative, and the winter beans then looking badly had not recovered, and were a very moderate crop.

Root Crops.—Twelve acres sown with mangolds did not plant well, and were redrilled with swedes, but owing to the drought the latter had not made an appearance above ground at our last visit. The other mangold piece, 16 acres, was a fairly good plant, not quite so close in some places as might have been wished for, but well forward. The swedes had come up somewhat irregularly in one of the fields, patches being fit for the hoe, with others scarcely out in rough leaf, but the dropping weather

experienced in July would doubtless render a full crop a matter of certainty. The other piece of swedes was a good plant and had been hoed.

The clover had been cut and made into a very large stack of prime hay. We noticed that an elevator had been used to economize and expedite the labour of pitching.

The gates were in good order, and the fences very excellent, bearing the impress of many years' careful and skilful treatment; and in the arable fields cultivation was carried close up to them.

While we have much to say for Mr. Smith's fences, the cleanness of the farm, and the generally good arable land management, we cannot hold up for imitation the practice pursued with reference to live-stock. Doubtless he is heavily handicapped by insufficient building for winter accommodation, but the widely different numbers, and the disproportion of hoof to horn existent on the farm at our different inspections, conveyed the impression that no definite system in this department is followed. Nevertheless, for other reasons, we thought him well entitled to the commendation which we awarded to him.

Class III.—First Prize, £50.

Mr. Spencer Turner, Hunston Lodge, Bury St. Edmunds, Suffolk.

This farm is situated 9 miles east of Bury St. Edmunds, and is the property of A. M. Wilson, Esq., Stowlangtoft Hall. It contains:

Arable land	129 acres.
Grass „	40 „
Total	169 „

It has been in Mr. Turner's occupation since 1876, he having succeeded his father, who was the tenant for 25 years previously, and he holds at a rent of 212*l.* 10*s.* per year.

He also occupies land adjoining, the property of Major Heigham, of Hunston Hall, consisting of,

Arable	48 acres.
Grass	17 „
Total	65 „

This he has held from 1881 at a rent of 97*l.* 10*s.* per year, and it will thus be seen that his total acreage is 234 acres, and that he pays a total rent of 310*l.* per year. He also pays a tithe rent charge of 37*l.*, and his rates average 28*l.* per year.

The dwelling-house and farm buildings are centrally situated, and though old and without any pretence to the labour-saving arrangements and convenience of modern erections, they are tolerably commodious and are made the most of. One of the ends of a large barn has been converted into boxes for fatting cattle, while the other end is used as a store for their food. Another improvement has been throwing a roof over an open yard, and something more in this direction might with advantage be done.

Besides Mr. S. Turner, the household consists of Mrs. Turner, his mother, who is assisted by her sister and Miss Turner, her daughter. In addition to the usual routine work of a farmhouse, they, without the aid of a servant, attend to a dairy of 8 cows, and a large number of poultry. Indeed, industry is the *mot d'ordre* throughout the establishment. A younger brother living with them doffs his coat and takes full share of whatever work is going on, although from a piece of his property in the stables we should fancy he is not averse to a day's hunting when he can get it; while on our first visit, so late in a November afternoon "that the stars had begun to blink," we surprised the master of the farm "whistling at the plough." The postcard heralding our advent had miscarried. It is pleasant under any circumstances to note industry so conspicuously persevering as it is seen here; but that pleasure is much heightened by the knowledge that it is directed with judgment, and in this case, as the sequel will show, attended with success.

About 30 acres of the farm is a good friable soil; the remainder a clay loam, more or less heavy, resting on a subsoil of clay, and very untractable to deal with. All of it required drainage, and has been drained. As to 20 acres, laid with tiles, the whole expense was borne by the owner; while the remainder has been drained with wood * at the joint expense of the owner and the occupier, the former providing the faggots, the latter cutting the drains and putting them in. On the arable land the distance apart varies from 6 to 8 yards, and on the grass from 12 to 20 yards. Depth, $2\frac{1}{2}$ feet.

The rotation of cropping followed is the four-course, although the tenant is not restricted to it by agreement. First, wheat, which is sown after clover, peas, or beans. Mr. Turner's great endeavour is to break up the land when dry, and have it as much like fallow as possible. Farmyard-dung, at the rate of 16 loads per acre, is spread on the land previous to breaking it up. He drills early, using 7 pecks of seed per acre; in spring,

* From this, as also from the practice on Mr. Scrutton's farm, it will be seen that bush-draining still exists in Suffolk.

he rib-rolls, harrows, and hand- and horse-hoes all he can. Harvesting costs 12*s.* per acre, and threshing 1*s.* per coomb.

Roots and green crops succeed the wheat. Land intended for mangolds is ploughed as soon as convenient after harvest, and in the course of the winter is drawn into ridges 27 inches wide. About the end of March, farmyard-dung is spread between the ridges, and 4 cwts. of Fison's artificial manure sown above; the ridges are then split back, and in April, 5 lbs. of seed per acre drilled on them.

The swede land is ploughed after harvest, but cultivated in spring; 4 cwts. of manure per acre are sown over the land, which is then ridged up and sown. Another portion of the wheat stubble is ploughed directly after harvest, and drilled with rye and tares for spring feed for sheep. After the crop is fed off, the land is broken up; and white turnips, cole, or mustard is drilled on the flat at 16 inches apart. All the mangolds are drawn off, but the greater part of the other crops are consumed on the land by sheep.

Barley and usually a few acres of oats follow the root-crops, the tilth for which is got as fine as possible, and the seed drilled early at the rate of 9 pecks per acre for barley, and 13 pecks for oats. The rib roller is used, and then horse- and hand-hoes, and clover-seeds afterwards are sown on about two-thirds of the land—the remainder unseeded is followed by peas and beans. A portion is seeded with clover and rye-grass mixed, but most of it by clover alone. Red clover is sown at the rate of 12 lbs. per acre; white clover, 8 lbs. per acre; and trefoil, 14 lbs. per acre.

Half of the red clover is mown for hay, the other half fed off by sheep, and then left for seed. Four cwts. per acre of clover-seed, Mr. Turner considers, is an average crop with him. He mentioned that the droughty summer of 1884 destroyed a field of young clover he had sown in the spring; but immediately the corn crop was off he sowed again, with the result of an excellent piece in 1885, which he fed till June and then seeded.

The following are abbreviated notes of our last inspection of the crops:—

"Five acres of mangolds, not quite a close crop, wireworm being among them, but healthy and like growing: 5 acres of swedes, part of mangold field, a close and excellent plant: 11 acres of barley, after swedes fed on, and mangolds carted off—the whole good—the former a big crop: 8 acres of wheat, after red clover fed off and then seeded; an excellent piece, estimated to yield 5 qrs. per acre; this is the field where the clover was sown after harvest: 8 acres of white clover, being folded with sheep, good for the season, will be broken up for wheat: 8 acres of Canadian oats—seed from Webb's—after clover mown

and seeded, a very great crop, the largest seen on any of the competing farms: 5 acres of peas after oats, very good: 6½ acres of beans after barley, a fine crop, but rain wanted to mature podding: 6½ acres of mangolds, the best we had seen up to this time, very grand plants: 7 acres of red clover had been mown and are now laid up for seed: 18 acres of wheat, after beans and peas, crops very good: 5½ acres of winter beans, very good: 15 acres of sundry green-crops—tares, thousand-headed cabbage, white turnips, and a piece unsown, but intended for mustard. Barley all good, except 9 acres sown after rye-grass folded, which was the poorest crop of anything on the farm: 23 acres of meadow mown had not been a large crop, but was best where folded with sheep eating cake."

The whole of the crops were very clean. The first piece of barley, mangolds, and swedes mentioned are on part of Major Heigham's land, which Mr. Turner has occupied since 1881, and was when he took it, we understand, in a poor and foul state. He thus describes it: "The 65 acres I hired in 1881 were in a very bad state, poisoned with weeds, and completely farmed out."

Fences.—On soils such as this farm is, the white-thorn grows shyly; but nevertheless the greater part of the fences were very good, neatly trimmed, the ditches scoured, and all in good order.

Live-Stock.

Cattle.—In this matter the safe plan of breeding and rearing the most of the stock required for the consumption of the produce grown on the farm is adopted. Eight milch-cows are kept, and timed to calve in the autumn, the object in view being a winter butter dairy. Mrs. Turner attends more immediately to the dairy, the only speciality about the management being the most scrupulous cleanliness. She prefers wooden vats for the milk, finding that it then keeps much better in hot weather than when set in lead or earthenware bowls. It is necessary to scald them with boiling water after use. A ready market is found for the butter among the villagers until the price gets over 1*s*. per lb., when they cease to buy it, and it is then sent to Bury. Without vouching for perfect accuracy, Mr. Turner puts his return for butter at 15*l*. per cow per annum, being double the sum per cow produced at the beginning of the present century.

The skim-milk is used to rear the calves; and besides those dropped by the cows, as many are bought and reared as are necessary to keep up the head of stock—amounting to an average number of 40 all the year round. Many of these are not depastured at all, but reared and fattened in the yards, and

go to the butcher at about twenty-two months old. They are carried on gradually from birth to death, pulped roots and chaff being their staple food for eight or nine months of the year, the remainder being a change to green food, tares, clover, &c. Cake and meal are supplied all the time, increasing in quantity until 3 lbs. of the former and 1 peck of the latter (compound of wheat, beans, maize, and lentils) are reached, which is the daily quantity given per head during the finishing stage.

The characteristics of the cows savour more of use for the dairy than symmetry attractive to the eye of the grazier; but a useful pure-bred Shorthorn bull is kept to cross with, and the fatting cattle lacked none of the points which a butcher would consider essential.

The following is the stock that was on the farm in the beginning of May:—

Cattle.

Cows, in calf or milk	8
Calves under one year	12
Heifers under two years	2
Bullocks under two years	5
Fat and fatting bullocks	12
Fatting heifers	1
Bull	1
Total	41

Sheep.

Ewes	165	Several not lambed.
Lambs	147	
Tups	3	
Total	315	

Pigs—fat and stores	57
Horses, all ages	10

Pigs are not bred on the farm, but a considerable number are bought and fattened yearly. Between July 1884 and July 1885 84 had been so turned over, and this may be taken as an average. They are bought in at about 1*l.* each; and after three months' feeding on maize, barley, and lentil-meal, they realise on an average 3*l.* each.

Horses.—Seven are kept to work the farm, including a brood mare; and taking into consideration the texture of the soil, with the loss of time incurred by the mare breeding, the

number will not be considered too many. They are summered on green food in the yards, and rarely go to pasture.

Poultry.—The receipts from this source are somewhat considerable: 300 chickens and 70 turkeys, geese, and ducks are reared and sold annually.

Sheep.—With reference to the sheep stock, Mr. Turner has set himself the rather difficult task of keeping a permanent breeding flock of ewes on a clay-land farm. He patronises the breed for which the Bury district has long been famous, the Improved Suffolk.

The old Suffolk sheep were within his recollection "sharper in the face and thinner in the body" than the breed now existent. Judicious crossing has resulted in producing an altogether thicker and more massive animal, without losing the characteristic black face and legs.

He puts 170 of these ewes annually to the rams, turning in the latter, 3 in number, about the 11th of October. They are run on the stubbles during the day and folded on mustard at night till the middle of November, when they are folded on swedes with all the pea-straw chaff they will consume. This folding goes on until lambing time, when they are put into the yard at night, and have a small quantity of mangolds, and a little cake and hay chaff—"In fact," says Mr. Turner, "we keep them well all through lambing." Rye is, as a rule, fit for stocking by the last week in April, on which and the grass pastures they are then folded—mangolds, cake, and hay being still continued. When the rye is finished they are folded on the clover layers, the lambs running forward and getting linseed-cake, split-peas, and lentils. The lambs are weaned and sold at the end of June, and shearlings are bought to make up for ewes drafted. This year the produce was about lamb for ewe—not a great increase, certainly; but Mr. Turner's average is equal to that of some other competitors who are breeders on soils much better adapted for sheep. As already noted, 30 acres of this farm is a friable porous soil, and he arranges so that one-fourth of this is yearly in roots, and on them he folds his ewes during the spring months. All the heavy land to be sown with corn he endeavours to have ploughed before January is out.

The working staff and the wages are as follows:—

2 horsemen, at 12*s.* each per week.
1 lad, also with horses, at 7*s.* per week.
1 shepherd, at 10*s.* per week.
4 labourers, at 10*s.* each per week.
2 boys, at 4*s.* each per week.

In addition, they have the usual 6*l.* each for harvest.

The cost of labour per acre over the whole farm is 22*s*. This is a very small sum, considering the nature of the soil, and the incessant cropping it undergoes. No account, however, is taken of what is done by Mr. Turner or his younger brother, but the circumstances afford an apt illustration of the truth of Dr. Franklin's adage—

> "He that by the plough would thrive
> Himself must either hold or drive,"

as no other farm in the competition cost so little per acre in labour.

In 1885 cakes were purchased to the value of 151*l.* 11*s.* 2*d.* Corn was consumed, partly grown on the farm and partly bought, to the value of 344*l.* The outlay for artificial manure was 30*l.*, besides all the manure that could be bought from the cottagers.

Like most of the successful farms in the competition, its condition is kept up by the consumption of large quantities of corn and cake by live-stock. An expenditure equal to 2*l.* per acre over the whole farm is yearly made for this purpose. The practice is sound if judiciously carried out. If cattle consuming this and other food pay their way, leaving the manure free, it must be more economical than incurring heavy bills for artificials to stimulate the growth of root and grain crops.

This farm is a good example of what may be accomplished by sound practical knowledge in combination with industry. It is cold heavy land, of second-rate quality. Such land, if out of condition, would probably at the present day go begging for a tenant; yet corn crops are produced on it, almost, if not quite, equal to any of those grown on the best farms in the competition. It is kept in beautiful order, yields rent, and that a high one, and we hope and believe affords fair remuneration for capital and labour to the highly-respectable and most industrious family who for thirty-five years have been located on it.

One of my colleagues supplies the following: "All the corn on this farm looks very well indeed, and is very clean. Some oats from Webb's seed was the best piece we saw in the whole of our visits, and, taking the farm on the whole, it is done as well as it can be, and reflects great credit on the young men who work very hard at it."

Two of Mr. Turner's labourers we recommend as worthy of the Society's Certificates of Merit, viz., William Plummer, employed as an ordinary labourer, and William Stiff, as horseman. Years of servitude of the latter, twenty-three; and the former has worked on the farm for forty years. Both certified to be excellent workmen, with good moral characters.

Class III.—Second Prize, 25*l.*

John Bayly and Son, Hardingham Station Farm, Hingham, Norfolk.

	A.	R.	P.
Arable land	160	3	30
Grass	45	2	33
Waste, roads, water, &c. ..	15	0	8
Total	221	2	31

This farm is the property of the Earl of Kimberley, and is situated 5 miles from Wymondham, and 3 from Hingham. The railway from Wymondham to East Dereham cuts it in two, and, very conveniently for its occupants, plants a station within its precincts. Mr. George Bayly, father of the present senior partner, became tenant of the farm at Michaelmas, 1833, and farmed it until 1858, when he was succeeded by Mr. John Bayly, so that the farm has been occupied by the family for fifty-three years.

The senior partner has a business at Yarmouth, and the farm is almost wholly under the control of his son, Mr. George Bayly.

At the outset we may say that all the farm-accounts are kept in a most ample and complete manner; and I was greatly assisted in drawing up this report by extracts from them, which will appear in the report of the farm, and which Messrs. Bayly so readily and courteously rendered.

The first bear on the rent, tithe, and rates, paid for twelve years, ending the 11th October, 1884, and show that the highest outgoings on these accounts were in 1875, 419*l.* 12*s.* 9*d.*; the lowest were in 1884, 384*l.* 16*s.* 2*d.*; the average for twelve years was 405*l.* 16*s.*

The tenancy is a yearly one, and the cropping is restricted to a four-course rotation, but liberty to depart from this is granted when asked for, if reasonable grounds can be shown for its necessity. The tenants have also been allowed to sell hay, but of late years have bought rather than sold.

The farmhouse and buildings are situated within five minutes' walk of the Hardingham Station. They are principally old, but afford ample accommodation for all the requirements of the farm, and the arrangements for feeding, &c., are tolerably convenient. The house, garden, and surrounding, are kept in nice order.

The farm lies rather wide, that portion severed by the railway

extending in narrow belts to a considerable distance south and west from the buildings. The soil is a very useful, and for the most part, a good free-working loam, resting on a subsoil of gravel, loam, and clay. A portion where the subsoil is clay required draining, which has been done to the depth of 4 feet. The grass-land is on the north side of the house, bounded, and in part intersected, by a stream, a tributary of the River Yare.

In growth the grass is profuse, but its quality is only second rate, and Messrs. Bayly feed it with milch-cows, as profitable a purpose perhaps as it could well be turned to.

The predominating feature in the economy of the farm is the production of milk. All is subordinate to this. The total root- and green-crops grown are consumed (except what the cart-horses may get) by a herd of 40 cows and their progeny, and the milk they give is sent twice a day to London. As the railway-station is practically at the dairy-door, where the milk is refrigerated before being sent off, and the cost of carriage to London is only one penny per eight pints, the situation is one peculiarly favourable for such a business.

The milk is delivered to a dealer—fixed quantities to be supplied and taken at a contract price—between April and October inclusive, of 14*d.* per 17 pints; and from October to March inclusive, of 19*d.* per 17 pints. These are reduced prices, higher ones having been obtained a year or two ago. The return in money-value of milk sold per cow per annum Messrs. Bayly could not give us, stating, "that with an arranged scale as to quantity to be delivered, they sometimes have to buy cows in full profit to keep up supplies, and sell cows out of profit to make room for them, and also take in springing heifers for that purpose that could not be called cows; therefore they cannot come at any reliable statement, and it might be misleading if they made one." They quote the yield given by one cow from 19th December, 1885, to 10th July, 1886. She calved on November 5th, 1885. On 19th December, she gave 56 pints per day; between 19th December and 20th March, she gave 37 pints per day; from 20th March to 30th June, 34 pints per day; from 30th June to 10th July, 30 pints per day. She must, however, be a milk-giver far beyond the ordinary. Nearly 1200 gallons within eight months is an astounding quantity for a cow to give; and if her milk-secreting powers are transmitted to her descendants, they will, indeed, prove valuable animals, small frame being considered.

At our November and May visits the live-stock on the farm were as follows:—

November.		May.	
Cattle:—		*Cattle*:—	
Cows in calf or milk	42	Cows in calf or milk	38
Heifers	10	Cows, fatting	5
Calves	18	Heifers	9
Bulls	4	Young Bulls	3
		Old "	1
		Calves	14
	74		70
Horses:—		*Horses*:—	
Cart-horses	7	Cart-horses	7
Cobs	2	Cobs	2
(One of the cobs kept for milk-cart, working root pulper, &c.)			
	9		9
Pigs	7	Pigs	4

We may state that the Red Polls are greatly in favour with Messrs. Bayly, and that 50 head of the above are pedigree-animals of that breed. They also contemplate having all the cattle they require on the farm of this breed.

The feeding and treatment of their cattle are very carefully and systematically gone about, a few particulars as to which I will now give.

Winter-feeding.—All the roots are passed through "Moody's Shredder" worked by pony-power, and mixed as follows: one-third roots, one-third cut-hay, one-third straw, all by measure. These are mixed one day and used the next. Each cow gets as much of this mixture as she can eat up clean, with an allowance of concentrated food besides, chiefly decorticated cotton- and linseed-cakes, the quantity varying from 2 lbs. to 7 lbs. per head per day, and is governed by the milking position, and other circumstances of the animals individually.

All the houses are well ventilated without draughts, and the whitening-brush and disinfectants are freely applied.

Summer-feeding.—All the cows and young cattle go to pasture as soon as possible after the grass has grown a little. The winter allowance of cake is continued to the cows, and is mixed with a little chaffed-grass and shredded mangolds, a portion of the hedge-banks being daily trimmed to procure the former. It is considered an essential point always to give the cows something nice to eat while being milked, it attracts their attention from the milkers, and the milk flows more freely.

Treatment before and after Calving.—About ten days before a cow is expected to calve, she is put on a pasture very short of feed, and given a Sutton's drench, with 1 lb. of Epsom salts,

and 1 ounce of ginger in beer; and this is repeated two or three days before she is likely to calve.

After calving, 3 ounces of sulphur, 2 ounces of nitre, and the yolk of an egg, mixed in strong beer, are given, and as much bran-gruel as she wishes to drink, say $\frac{1}{4}$ peck of fresh bran put into a pail, and well scalded, and cold water then added to the brim. More than one cow Mr. Bayly has known to have been killed by repeated heavy bran-mashes.

Liberal applications of carbolised oil, composed of one part of No. 1 carbolic acid, and seven parts of olive-oil, are made by the syringe to the injured parts of cows which have had a hard time in calving, or which calve in hot weather.

In cases of milk-fever, which he finds cannot be altogether prevented amongst heavy-milking cows, their first endeavour is to open, and keep open, the bowels; oil, treacle, Sutton's drench, salts, &c., are used for this purpose. Then a free administration of stimulants, old ale and whiskey, a bottle of each to begin with is not too much. The first case they had at Hardingham, now some years ago, for which spirits were given, was a very bad one, the cow having been down some time, and had been given up by the veterinary. Repeated doses of brandy, $\frac{1}{2}$ a pint every two hours, were administered, until she had taken $14\frac{1}{2}$ pints in 29 doses, when she rose, recovered, and afterwards did well.

Rearing of Calves.—Calves are allowed to be with their dams for four meals after birth, and are then taken off and given new milk for ten days. The new milk is gradually reduced from that time, and Ayre's calf-meal mixed with boiling water is substituted in such increasing quantities that by the end of twenty-one days the substitution is complete, and the animal is wholly on the meal and water mixture, which is continued until it can eat well other nutritious food. Bran and oatmeal are found to be the most wholesome and suitable food for calves under six months old. A bunch of sweet hay is placed in a net to amuse the calf and teach it to eat, and each one has a separate pen with a small manger for some time after it has left off the meal and water mixture, to prevent the sucking propensities which, at this stage of existence, they have a craving for, if placed two together. It is Messrs. Bayly's experience that calves usually do better without any water to drink until after the meal and water mixture has been discontinued.

Plenty of air above head, a clean bed of wheat-straw, and a free application of the whitening-brush are essentials conducive to the maintenance of health in the calf-house.

Before leaving the live-stock we may note Messrs. Bayly's peculiar mode of poultry management. Instead of the fowls

being permanently stationed, as is usual, at the homestead, they are moved from field to field over the farm; in summer on the grass, and after harvest on the stubbles. It being claimed that this access to "fresh fields and pastures new" is economical in the way of food, conduces to more vigorous health, and results in more eggs being dropped than under ordinary treatment. The fowls are housed in a wooden house on wheels, which a horse easily moves from place to place as required. They never stray far from their portable home, and return regularly to roost wherever it may stand.

The following extracts from Messrs. Bayly's Ledger will show that purchased concentrated food is also largely used on this farm. A record of the purchases of linseed- and cotton-cakes, and other feeding stuffs, for twelve years to the end of 1884, show that the greatest outlay during that period occurred in 1879, when the amount expended was 468*l.* 9*s.* 9*d.*, and the least expended was in 1873, the amount being 190*l.* 0*s.* 4*d.*, while the average expenditure for the twelve years was 341*l.* 7*s.*

Extracts of the purchased manure bills for the same time show that the largest outlay occurred in 1884, when it was 123*l.* 18*s.*; the least in 1876, when it was 56*l.* 15*s.* 2*d.*; the average of the twelve years being 87*l.* 4*s.* 1*d.*

Cropping and Management of Arable Land.—In walking over the farm in the autumn we found the stubbles very clean, couch very difficult to find, and very little of any other perennial or annual weeds.

The mangold crop was secured, but judging from what we saw at the clamp, it had been a good one. The swedes were being taken up, and the crop was excellent.

As previously intimated, the cropping rotation is the ordinary four-course one. The cultivation for which is much the same as what we have already described, but the manuring is somewhat different; no sheep are kept on the farm, and none of the root crops are consumed on the land; this necessitates a top dressing to the succeeding barley crops. This year 43 acres of barley are grown, chiefly Hallett's Pedigree. Ten pecks per acre of seed were sown, and at the same time a dressing of Bayly, Sutton, and Co.'s barley manure, at a cost of 23*s.* per acre. One small field was scalded by the drought, and was short in straw, but the other two fields very good, one particularly so.

Messrs. Bayly's account for 12 years, from 1872 to 1884 inclusive, show that the best crop of barley was grown in 1883, and produced 56 bushels per acre; the worst, grown in 1876, produced 37 bushels; the average yield for 12 years was 47 bushels. The greatest value per acre was obtained in 1874, and

was 13*l.* 4*s.* 7*d.* per acre; the lowest, in 1881, was 8*l.* 1*s.* 1*d.*; the average value for 12 years was 9*l.* 19*s.* 10*d.* per acre.

The price of barley per bushel in 12 years, all sold, averaged 4*s.* 3*d.*; the highest price was obtained in 1876, and was 5*s.* 3¼*d.*; the lowest in 1878, 3*s.* 4¼*d.*; Willich's returns for the same 12 years give an average of 4*s.* 5¾*d.*

Wheat.—Thirty-seven acres after clover layers were manured with 10 loads of farmyard-manure per acre, spread over the land, and ploughed in; and seed was drilled at the rate of 8 pecks per acre, the varieties being "Club head," from Lord Kimberley's, and Scholey's "Square head," direct from Mr. Scholey. Early in spring a top-dressing was given of 4 stones of sulphate of ammonia, and 8 stones of salt. This crop generally was rather thin but well headed, and would yield quite as well as it looked.

The statistics for 12 years showed that the greatest crop was in 1878, yielding 52 bushels 1 peck per acre; the least in 1876, yielding 32 bushels; the average crop for 12 years, from 1872 to 1884 inclusive, was 39 bushels.

Then, as to value: the highest sum obtained per acre was in 1874, and was 17*l.* 2*s.* 7*d.*; the lowest in 1883, 7*l.* 18*s.* 10*d.*; the average for 12 years, 11*l.* 10*s.* 5*d.*

Price per bushel: highest in 1873, 7*s.* 10*d.*; lowest in 1884, 4*s.* 2¼*d.*; average for 12 years, 5*s.* 10*d.*; Willich's returns average for the same 12 years, 5*s.* 10½*d.*

Clovers.—The seeding for clover-layers is ½ peck of red clover, ½ peck of trefoil, 3 lbs. of white clover, 3 lbs. of alsike, 1 peck of Italian rye-grass. The first crop is mown for hay, and the second growth fed off by the cattle.

Root Crops.—Mangolds, 9 acres were grown this year, for which 15 loads of farmyard-manure per acre was spread on the stubble and ploughed in; and, previous to ridging the land for sowing, a dressing of Bayly and Sutton's mangold-manure to the value of 30*s.* per acre was sown over it. In July the plant was most excellent, with few gaps, very forward and clean, and gave every indication of a large crop.

Swedes.—Twenty acres sown after wheat: no yard-manure was given to these, but 30*s.* worth of turnip-manure at the time of sowing,—2 lbs. of seed per acre being used on 24-inch ridges. This is a very light seeding, and part of one field was so much decimated by the fly as to require resowing. The second braird, at our last visit, had just got into rough leaf, and would no doubt turn out all right; but in all probability another 1½ lb. of seed per acre would have saved the first one. There was a capital plant in another field:—close, growing vigorously, and well forward.

Five acres of white turnips getting 25*s.* worth of Bayly's turnip-manure, sown with $1\frac{1}{2}$ lb. of seed, had in part succumbed to the fly, and required resowing; more seed might possibly have rendered this unnecessary. There was a good plant in July.

Cabbages.—One-and-a-half acres had got 14 cartloads of farmyard-manure, and 30*s.* worth of "cabbage manure" per acre. One lb. of seed per acre was drilled on the ridge. They also were very promising.

One-and-a-half acres of tares, and $2\frac{1}{2}$ acres of lucerne, sown near the farm buildings to be handy as green food for the cows, had been heavily dressed with farmyard-manure and compost soaked with liquid from the manure tank. Seeding for the lucerne amounted to 20 lbs. per acre. A great weight of produce will be turned off here.

What will strike most practical men as the weak point in the management of this farm is the want of sheep, which necessitates an outlay of 50*l.* per year for top-dressing the barley crop. Moreover, the cartage to the homestead of all the roots, instead of, as in ordinary farming, half being consumed where grown, must add very considerably to the cost of labour both for man and horse. All, however, depends on nett results, and if the end justifies the means, no more need be said. That it does so is more than probable, or we should not find so close a calculator and accurate book-keeper, as the senior partner assuredly is, go on with it.

The labour bill for 12 years to 1884, averaged per year 349*l.* 15*s.* 1*d.*; the highest year being 1875, 381*l.* 13*s.* 5*d.*; the lowest year being 1881, 320*l.* 3*s.* 5*d.*

The cost per acre on the whole 221 acres averaged 1*l.* 11*s.* 7*d.*; excluding waste and calculated on 206 acres, 1*l.* 13*s.* 11*d.*; calculated on the arable only, 161 acres, 2*l.* 3*s.* 5*d.*

Mr. Bayly was able to give the averages for labour on the same farm for 12 years previous to 1870, which we insert as showing what a serious increase there has been during the last quarter of a century, not less, according to this showing, than 38 per cent. The farm, however, was then managed on ordinary lines, a sheep stock as well as grazing cattle kept, and something considerable must be allowed for this.

Labour bill, average of 12 years to 1870, 253*l.* 3*s.*

Cost per acre on 221 acres, 1*l.* 2*s.* $10\frac{3}{4}$*d.*; on 206 acres, 1*l.* 4*s.* $6\frac{3}{4}$*d.*; on 161 acres, 1*l.* 11*s.* $5\frac{1}{4}$*d.*

The labour staff and the average wages paid are as follows:—

Head cowman, 14*s.* per week and 7*l.* 10*s.* standing wages, cottage and garden rent free.

Second cowman, 13*s.* per week, 5*l.* standing wages, no cottage.
2 teamsmen, 12*s.* 3*d.* per week, with 6*l.* 12*s.* 6*d.* extra for haysel and harvest, and also the option of piece work.
4 ordinary labourers, 11*s.* per week, with 6*l.* 12*s.* 6*d.* extra for haysel and harvest, and also the option of piece work.
2 boys at 7*s.* per week.

The capital invested in the farm, as shown per Michaelmas valuations, was greatest in 1880, amounting to 3229*l.* 6*s.* 6*d.*; was lowest in 1875, 2692*l.* 12*s.* 11*d.* Average of 12 years, 2996*l.* 19*s.* 8*d.*

The valuation is made when all the crops are in hand, which swell it to the formidable sum of 13*l.* 10*s.* per acre; but it must not be inferred from this that so large a capital is requisite to commence and carry on the business on such a farm. Practically it would be found that two-thirds of it was ample.

We were also favoured with the amount of average profits for the 12 years referred to, which, in keeping with the yield and value of crops, varied much, and with the current range of prices of farm produce cannot be expected to be large at present; yet they are realised, fulfilling the first condition laid down for our guidance, which, with the good all-round management of Messrs. Bayly, we considered well entitled them to the Second Prize.

Class III.—Commended.

Mr. Joseph Smith, Thorpe Hall, Hasketon, Suffolk, for the Walnut Tree Farm, situated in the parish of Henley, and 8 miles distant from Ipswich, containing

	A.	R.	P.
Arable	148	0	0
Grass	20	2	22
Total	168	2	22

He holds it on a ten-years' lease, dating from 1880, the owner being James Clark, Esq., Beech-hanger, Caterham Valley.

The rent is 240*l.*, tithe rent-charge 51*l.*, and rates and taxes about 29*l.*, making in all about 320*l.* per year.

He crops on a four-course rotation, although the covenants of his lease do not deter him from doing otherwise; but they bind him at its expiration to have one-half of the arable in white-straw crops; one-fourth in beans, peas, tares, clover, or rye-grass; and one-fourth in root-crops or fallow.

The greatest proportion of the farm is a heavy loam resting

on boulder-clay, with a small portion of "mixed soil" on a more porous subsoil.

Since Mr. Smith's entry to the farm, 100 acres of it have been drained, 3 feet deep, at distances ranging from 9 to 12 yards apart, the owner providing the pipes, and the tenant paying for labour.

Mr. Smith occupies other farms, in extent 570 acres; and as he lives at a distance of 7 miles, he keeps a working bailiff, who resides in the farmhouse, and who carries on the work under his direction. The ordinary working-staff consists of 1 bailiff, 2 horsemen, 1 stocksman, 4 ordinary labourers, and 2 boys, whose weekly wages amount to 4*l.* 17*s.* 6*d.* The bailiff has free house and fuel found him; the others make a harvest-earning of about 9*l.* in four weeks, the boys in proportion. Women are also occasionally employed, and in busy seasons "gangs" can be obtained, this mode of obtaining labour being yet existent in Suffolk. The entire labour for the year was stated as amounting to 380*l.* Some considerable deduction ought to come off this for the bailiff's time; but after such allowance is made, the cost per acre will be found about 40*s.*, which is very high.

This farm being in the nature of an accommodation one, the number of stock kept on it varies much, being moved to and from Mr. Smith's other farms as circumstances require. He breeds on those farms most of the stock necessary for the consumption of produce on this, and has one of the oldest-established flocks of the improved breed of Suffolk sheep in the county.

The following were on the farm at our November and May visits:—

November.		May.	
Cattle:—		*Cattle*:—	
Fatting	14	Red-polled, in-calf, heifers ..	7
		" heifers, under 2 years	15
		Bullocks, under 2 years ..	7
		Fat bullocks	2
			31
Sheep:—		*Sheep*:—	
Hoggets .. .. (The farm had kept 169 of these for 108 days, they having left it to go to another on April 8th.)	190	Shearling ewes .. .. (These Mr. Smith stated were here for a short time only.)	100
Pigs:—		*Pigs*:—	
Various ages	32	Various ages	46
Horses:—		*Horses*:—	
Cart-horses	6	Cart-horses	8

A most liberal use of feeding-stuffs is indulged in, the purchased cakes and corn consumed on the holding amounting in 1885 to 409*l.* 2*s.* 3*d.* in value; and in addition 155 coombs of peas and beans, and 26 coombs of barley, grown on the farm, also went into consumption, the estimated value of which is 140*l.*, the two together making 551*l.* 2*s.* 3*d.*, equal to an expenditure of 65*s.* an acre over the whole farm. Owing to moving the stock from farm to farm, no reliable estimate of the return obtained from this large outlay can be formed; but there can be no doubt as to its fertilising effects on the soil, and the excellent crops which we saw this year go to prove that it has already borne fruit.

Artificial manures are also purchased, to the extent of 40*l.* per annum.

Wheat following Clover layer.—Sixteen loads of farmyard-manure per acre are applied to the latter as a dressing for the wheat, and 7 pecks of seed per acre are drilled. Twenty-one-and-a-half acres are this year in this crop.

Barley.—Twenty-one acres were sown after roots consumed on the land by sheep eating cake; seed 10 pecks per acre. The greater portion of this was a very good crop, but one or two places were deficient where wet weather had intervened, showing that only in dry weather can roots on this description of land be folded with sheep to advantage. Fifteen acres after peas and tares were also good. Manure had been applied for the peas, and none after for barley; but, where the tares grew, 14 loads of farmyard-manure was given.

Beans.—Nineteen acres; one field very good, the other fair.

Peas.—Ten acres after barley; had 13 loads of farmyard-manure per acre, and were a very good crop.

Mangolds.—Twelve acres, the cultivation for which is:—plough directly after harvest, lay rough for winter, heavy harrow in spring, then ridge; apply 25 loads of yard-manure and 3 cwt. of beet-manure per acre, split back and sow 6 lbs. of seed mixed with ½ lb. of swede seed per acre.

Swedes and White Turnips. — Fifteen-and-a-half acres, the culture for which is:—stubble broken up directly after harvest; in spring (when dry) ploughed and cultivated; manure spread over the land and ploughed in, and drilled with 3 pints of seed per acre. Mr. Smith's motto is, "Never let the work drive you, but if possible always be a little before it."

The arable is cultivated on the 9-feet stetch. After it was drained, an attempt was made to increase the width of the stetches; but experience proved the utility of a hark back to the "corduroy," which the late Mr. Mechi used to designate land so laid up. This mode of dealing with clay soils is quite the

rule in the eastern counties, but is seldom seen elsewhere. Tenacious clay soils possess the properties of expansion and retention in a much greater degree than that of transmission, and hence, however well the land may be drained, when a considerable and continuous rainfall occurs, these properties so prolong percolation, that unless an escape by the surface is provided, the young plants inevitably suffer more or less. A headland holding water, being sown when too wet, and so perishing the plants, is a circumstance familiar to most practical men; and something like this, but in a less marked degree, takes place on clay land when laid on wide flat ridges without water-furrows, to obviate which the Suffolk farmer ploughs up as aforesaid into stetches about 9 feet wide. Mr. Smith's land is all cultivated on this stetch, and in a neat and most workmanlike manner. After ploughing, the horses are not allowed to travel on the stetches, but all the after-cultivation (dragging, harrowing, and drilling) is done from the furrows. Some farmers have drills wide enough to cover one of them, and in this case the horses walk up the furrows on each side, with the drill between them. Others, like Mr. Smith, use a drill covering half the stetch only, and here they go up one furrow and down the other to cover it. After sowing, a double-breasted plough is run up the furrows, affording a free waterway for such water as does not filter to the drains. In spring, the breasts are taken off the plough, and skim-knives are attached, and again passed along the furrows, cutting up the weeds, and by mouldering down the sides, facilitating the working of the reaping-machines at harvest.

Clover Seeds.—The mixtures for these are various. This year 6 acres are seeded with a mixture of clover, trefoil, and rye-grass; 14 acres with 1 peck per acre of red clover only, and 6 acres seeded with sainfoin, at the rate of 1 sack per acre; 8 acres of red clover were cut for hay, the second crop would probably stand for seed, and 5 acres of mixed grasses were fed on the land. None of the grass-land was mown this year. It is only of poor quality, and kept up by folding on sheep eating cake.

The fences are good, and very neatly kept, the banks are trimmed, and the ditches are in good order; in fact, an air of neatness and order pervades the whole farm. Mr. Smith lets the trimming of his hedges, banks, and ditches, the following prices being paid: for cutting hedge and trimming ditch and bank, 1*d.* per rod of 5½ yards; for fence and bank, ½*d.*; and for brow or border only, ¼*d.* per rod.

Some cottages with clay walls exist here, the framework being wood filled in with clay. The outside surface requires skimming

over once in two years; this being attended to, prevents ravages by wet and frost, and renders the erections very long-lived. The first cost is not more than half that of modern brick buildings. Besides two clay cottages, a modern brick-built double one, with accommodation for two families, is on the farm.

To sum up, the cultivation of this farm is particularly well done. The crops are all good, and the land is clean. Stock management, for the reasons mentioned, we cannot say much about, but we have no reason to doubt its being carried out with efficiency and judgment. But we failed to see anything like adequate or compensatory returns for the large outlay for labour and purchased food; and in the absence of any evidence to the contrary, it remained with us as a matter of doubt whether 'General management with a view to Profit' obtains on the farm, and we must leave such of our readers who have followed us thus far, and who have a *penchant* for the speculative, to take the figures and strike a balance of probabilities for themselves.

Class III.

Mr. Wm. S. Grimwade, Broughton Hall, Stonham, Suffolk.

	A.	R.	P.
Arable land	175	1	0
Grass-land	56	1	0
Total	231	2	0

This farm is situated 5 miles from Needham Market, and is the property of the Trustees of the late Sir W. F. F. Middleton. The house, as its name betokens, had at one time been one of some importance. It has a very fine kitchen, with a curious old clock, 350 years old, the maker's name being 'Dread, of Ipswich.' The house is now partly surrounded by a moat, full of water, and apparently has at one time been entirely so surrounded. The remains of a drawbridge were removed a few years ago.

Mr. Grimwade has occupied the farm for 9 years, succeeding his father, who, as tenant, held it for 37 years previously.

He occupies as a yearly tenant, with no restriction as to cropping; but the sale of produce, other than grain, is prohibited, although permission to sell is usually granted when asked for.

He pays 353*l.* per year rent to the owner, and to the tithe-owner 63*l.* per year; rates stand to about 35*l.* yearly.

The soil is a heavy loam on a clay subsoil, and all needed drainage, which has been well done by the owner, at a depth of 4 feet.

The grass-land is good in quality, as indeed is the arable, and both are capable of producing abundant crops.

Mr. Grimwade farms on a four-course rotation, and grows a considerable acreage of beans—this year 17 acres, and 6 acres of peas—they taking the place of clover in the rotation. He also occasionally deviates from the common practice with regard to the crop succeeding the clover layers, sowing barley in place of wheat, and having 18 acres so cropped this year.

His labour-bill for 1885 amounted to 381*l.* 7*s.* 2*d.*, close on to 33*s.* per acre; purchased cakes to 90*l.*, and manure purchased to about 35*l.* yearly.

The live-stock on the farm in November and May were as follows:—

November.		May.	
Cattle:—		*Cattle:—*	
Cows	6	Cows	7
Calves	3	Calves	3
Bulls	1	Yearling heifers	2
		Fatting „	2
		Bull	1
	10		15
Sheep	0	Sheep	0
Horses and colts	10	*Horses:—*	
		Cart-horses	10
		Young horses	6
			16
Pigs:—		*Pigs:—*	
Sows	18	Sows	18
Other pigs	142	Boars	8
		Fat pigs	29
		Stores	72
	160		127

In November we saw some good mangolds, a large, dry, open ditch near the homestead being utilised as a clamp for them. A field of young clover had also planted well.

In May, the appearance of the crops we thought decidedly inferior to those of the other competitors in this Class. Nor was the cleanness of the land which they were sown on, or that in preparation for roots, at all redeeming points. These circumstances, taken in connection with the number of stock kept on the farm, together with its quality, led us to the conclusion that it would not be necessary to visit Mr. Grimwade again.

CLASS IV.—FIRST PRIZE, 25*l.*

Mr. Charles Devereaux, of Starston, Harleston, Norfolk.

Arable land	62 acres
Grass-land	26 „
Total	88 „

This farm, which is owned by Miss Elizabeth Barton, of Croydon, is situated about 2 miles from the railway station and small country town of Harleston, and has been occupied by Mr. Devereaux as a yearly tenant for 11 years, at a rate of 105*l.*; tithe-rent charge, 24*l.* 10*s.*; and rates about 9*l.* 10*s.* per year, all of which are paid by him. He is not by agreement restricted in cropping or sale of produce, but, grain excepted, his sales are only occasional and confined to clover-hay.

The farmhouse and buildings, abutting on a high road, are centrally situated, and of an old-fashioned type. A prominent feature is the usual big thatched barn, behind which are the cattle-yards, part of which have, at a cost of 34*l.* 10*s.*, been roofed over with corrugated iron by the tenant. The covered space is now divided into three compartments, so that the cattle can be fed in three lots. An adjoining yard with shelter-shed is bounded by the stable, cow-house, &c. A root-house built by the tenant (the owner finding the material) bounds the covered yard on the other side. One bay of the barn is used as a hay store; and in the other stands a chaff-cutter worked by horse-power from outside; space for storing cake is also afforded. A shed for carts and implements is detached.

The dwelling-house, with garden adjoining, is good and comfortable; but as a gardener Mr. Devereaux does not excel.

Soil, Rotation, and Cropping of Arable land.—The soil is a heavy clay loam, on a subsoil of boulder-clay, the most part of it being cold and retentive, and all requiring drainage. Sixty acres have been drained 2½ feet deep during Mr. Devereaux's occupation, the owner finding pipes, and the tenant paying for the labour, which cost him, on the arable land 1*l.* 2*s.* 6*d.*, and on the grass 1*l.* 10*s.* per acre. His total outlay on the whole being 91*l.* 12*s.* 6*d.*

The working staff consists of one horseman at 12*s.* 6*d.* per week, and one stocksman at 12*s.* 6*d.*, which, with the extra assistance required at "haysel," harvest, and other odd times, brings up the labour-bill to 106*l.* per year. This is exclusive of Mr. Devereaux's own time; but as he for the last 3 years has acted as bailiff on a farm adjoining, the property of Mr. Holmes,

of Gawdy Hall, it cannot be debited with more than, if so much as, one half of it, and if we add 20*l*., making the total 126*l*., it probably would not be far out, and shows the cost per acre to be about 1*l*. 9*s*. Before he became bailiff for Mr. Holmes, his staff was less by one man.

Purchased cakes and corn are consumed to the extent of 75*l*. yearly value, besides corn grown and consumed on the farm by stock other than horses, amounting yearly to 40*l*.

The yearly outlay for artificial manures, chiefly dissolved bones, with ammonia in some form added, averages 35*l*.

Two-thirds of the arable is cropped on the ordinary four-course shift—wheat, roots, barley, seeds—but on the other third this is deviated from, and an extra crop of corn is taken in lieu of roots, the rotation being wheat, oats, barley, seeds. Oats are substituted for beans, which to a limited extent on the other strong-land farms take the place of clovers; and though we do not say a word in justification of this rotation, we must bear witness to the fact that the crops so grown were excellent, especially the third white crop—the barley; and that the land was perfectly free from weeds of every description.

Roots.—Mangolds are chiefly grown; the preparation commences soon after harvest by looking over the stubbles and forking out any couch that may be in them. The land is then either twice cultivated by steam, if a set of tackle can be conveniently hired, otherwise it is ploughed 6 inches deep, three horses being required for the operation. In November, if possible, but in any case before the end of the year, it is thrown into 30-inch ridges, and so lays rough and open till the end of February; and if then dry enough, the manure, about 5 cwt. of superphosphate, balanced with ammonia as a mangold-manure, is sown broadcast over the ridges, which are then split back and allowed to remain until the beginning of April, by which time the surface is well weathered, and a tilth fine enough for the reception of the seed obtained. It is then drilled with 4 lbs. per acre, an unusually light seeding. The practice in thinning out, before this year, was to leave the plants 30 inches apart, which, with ridges 30 inches wide, gave a plant that had space on every side. This year the distance between plant and plant is from 18 to 24 inches, but even that distance, we think, is too wide.

It will be observed that the practice in preparation of the land for mangolds is identical with that on the First Prize Farm in Class 3, and is by far the most economical, and perhaps the only way to make sure of a plant on soils so heavy and tenacious in texture. It can only be done, or at least should only be done, when the land is clean and free from weeds.

Provided plant food can be extracted to make good crops of

mangolds from portable manures only, Mr. Devereaux's practice of depending on them is preferable to that of Mr. Spencer Turner, who, it will be remembered, carts farmyard-dung to his ridges early in spring, with the risk of poaching the land should it be at all wet, which at that season the chances are it will be. The mangolds we saw, so grown, last autumn were large fine roots, and apparently had been a good crop.

This year's crop was drilled on the 8th of April, and in the first week in May presented a very fine braird; while at our last visit on Monday, the opening day of the Show at Norwich, this being the last farm inspected, they were a most promising plant, the best we considered we had seen on any of the farms, and scarcely a weed of any description among them.

Oats.—One-third of the wheat-stubble, as stated, is cropped with oats, getting as manure 5 cwt. of superphosphate per acre applied at the same time as the seed. This land, after the oat-crop, as also that on which the mangolds grew, is sown with barley, superphosphate again being applied to the whole. Seed, 10 pecks per acre.

Seeds are sown with the barley-crop, the horse-hoe previously having been freely used. In the matter of clover-seeds, Mr. Devereaux is as liberal in the quantity sown as we consider he is niggardly with regard to mangold seeding: 17 lbs. of red clover and 1 peck of Italian rye-grass is the allowance per acre. This is rotated with trefoil, so that clover comes on the same land once in eight years.

A dressing of farmyard-manure is given to the seeds early in the succeeding spring, a practice that cannot be too strongly recommended. They are usually mown, and the second growth is fed off with lambs eating cake.

In the month of July, five or six furrows are ploughed *from* the hedge-banks all round the clover fields, and well cultivated to check creeping rooted weeds running from them, and also to germinate and so destroy any seed that may have been shaken from the hedgerow. Mr. Learner's practice as to this will be remembered; but Mr. Devereaux's is certainly more effective, and the vigilance thus displayed to guard against the approach of an enemy augurs ill for its permanence should it by chance obtain a footing.

A large and excellent stack of clover-hay had been secured before our last visit, some of which would probably be sold off the farm, this being done occasionally. A second light dressing of dung is, as a rule, applied to the layers before they are ploughed up for wheat, which with the former application must not only afford ample manure for that crop, but leave a considerable overplus for the mangolds succeeding; and this accounts for the good crops grown with an application of artificials only.

Wheat, which is sown early, completes the rotation, 7 pecks per acre of seed being used. This crop is also well horse-hoed in spring, and a self-binding machine was last year hired to economise the work of harvest.

In spring the whole of the corn crops were very promising; a good plant everywhere; all had been horse-hoed and were remarkably clean, and this promise was not belied by results in July. The field of wheat, 13 acres of Carter's Rough-chaff Club-headed White, had attained to an excellent crop, as thick on the ground as any we had seen, with large well-filled heads, and, given favourable weather to finish, looked like yielding quite 5 qrs. per acre.

Oats, 5 acres after wheat, manured as described, were also a very good crop, and likely to pay well for the purchased manure given them.

Barley, $9\frac{1}{2}$ acres after mangolds, was a very fair crop, but not so heavy as $5\frac{1}{2}$ acres sown after oats, being the third white corn crop in succession. This was a very capital piece, and the yield would be large. It was grown on one of the best fields of the farm; but making allowance for this, the perfect cleanness of the land after such a course of cropping, with the great bulk produced, is most creditable to the management.

About 13 acres of meadow are mown yearly, and a dressing of compost of farmyard-dung and road-scrapings is applied as manure. The grass-land, which is very poor in quality, is also occasionally helped by light dressings of the above, besides being fed off with sheep eating cake.

Fences.—Most of the hedges are bounded by ditches, and both are kept in perfect order, the hedges neatly trimmed and the latter scoured, with the banks of both dressed down by the sickle, which prevents weeds shedding their seeds, besides giving an aspect of tidiness to the fields. They were, we were told, in keeping with some which we saw adjoining, in a very wild and rugged state at the time of Mr. Devereaux's entry to the farm, and their present satisfactory condition is the result of eleven years' careful attention. He also stubbed up 110 rods of old fence, and piped and levelled the ditches, throwing four fields into two. The gates were in good repair, but several of them, like those already noted on other farms, were void of ironwork, and slipped into notches in posts to fasten.

Live-Stock.

Sheep or cattle are not bred on the farm, but all are bought that are requisite for the consumption of produce; the practice has been to buy the chief part of the cattle in the autumn and the

sheep in the beginning of June. The following were in stock at our November and July visits:—

November.		July.	
Cattle:—		*Cattle*:—	
Fatting heifers and bullocks	23	Fatting heifers	7
Cow	1	" bullocks	2
		Cow	1
		Calf	1
	24		11
Sheep:—		*Sheep*:—	
Hoggets	100	Lambs	106
Horses:—		*Horses*:—	
Horses	2	Horses	2
Brood mare	1	Brood mare	1
		Foal	1
	3		4
Pigs:—			
Sow	1	1 Sow and litter of pigs.	
Stores	8		
	9		

The Cattle in stock in November were chiefly a good sort of Polled Irish. They had been purchased at Norwich Hill, and were being fattened in the covered yard on 56 lbs. of mangolds and 6 lbs. of linseed-cake per day, the latter being increased to 8 lbs. as the cattle approached maturity. The mangolds are cut with Gardner's Cutter into shreds, and mixed with straw-chaff, and at night a feed of long hay is given. They are sold off fat about the end of February, and a smaller lot is purchased and kept on in the yards until July, when they are expected to be fit for the butcher and sold.

About 30 head are annually so fattened and sold at an auction mart; and from the auctioneer's returns we saw that 21 had been disposed of between December and the end of April at an average price of 19*l.* each.

The practice is, as will be seen, to fatten all in the yards, and not to graze—or at least very sparingly—on the grass; and in this respect the practice is much the same as that on the First Prize Farm in Class 3, the primary object of both being to combine manure-making with a paying production of beef.

Sheep are not wintered on the farm, but a clearance of the flock is effected in November. One hundred half-bred lambs, —cross of Down and Long wool—are bought in June, and grazed and folded on the grass pastures and second growth of

clover layers, with a daily allowance of cake, commencing with ½ lb. and finishing with 1 lb. per head. These are disposed of according to circumstances, sometimes partly to the butcher, and at others wholly to the turnip-land farmers to finish off on roots. As a rule, they pay their way well. About a score of rough hoggets are also purchased in April, and folded on the layers with 1 lb. of cake per head per day; and after 8 or 10 weeks' keep are again disposed of, leaving the value of the wool, and something besides to pay for cake and a contribution towards the rent. Water for the sheep is daily provided, and they also have access to rock salt.

Pigs.—Not much is done in the porcine line. A good brood sow of the Berkshire breed is kept, and her produce are sold as stores, the receipts from which average between 25*l.* and 30*l.* per year.

Horses.—These, three in number, are a good stamp of the Shire breed, one being a brood mare with a very good foal at foot, the latter having been awarded two second prizes at local shows this year. There is not much in their feeding or management that calls for comment, except that they are housed in the stable instead of being turned into the yards at nights.

As to this farm, one of the Judges writes:—"This is a strong, heavy-land occupation. On our first visit the tenant had a good lot of sheep running on the stubbles, having corn and mangolds, and his yards were full of fatting cattle. In July he had just secured a good stack of clover-hay, and bought over 100 lambs, which were on his seeds eating cake. His mangolds were the best we saw, and the cleanest. All his corn was very good, his land very clean, and his fences very neatly kept. I think it was by far the best cultivated farm we had visited."

Unquestionably then, although in a small way, this is one of the best cultivated and successfully managed farms in the competition; and the question that will suggest itself to practical minds is, what are the circumstances that have made it so? and what are the points conducing to this success that may be profitably imitated? We would say that much of it hinges on clean cultivation. The fact has been realised that it is much cheaper to thoroughly clean, and keep the land clean, than by yearly ineffectual attempts nearly approaching to, but never quite making it so. This acted on, three corn crops can be taken in succession, the total absence of weeds allowing the last crop as thoroughly to utilise the resources of the soil and manure as the first did.

Roots are so difficult to grow on soils of this description, and so valuable when grown, that a good crop is tantamount to success for the year, and the want of it means disaster. Nor does it end here, for the loss of manure that their consumption

would have produced tells very adversely on future crops. Owing, however, to the cleanness of the land, the ready process of cultivating for mangolds already described is possible, rendering a good braird of plant an absolute certainty, and the cost of labour little more than half that incurred when spring ploughing and cultivating is reverted to; moreover, on such soils this latter mode of procedure entails great uncertainty of crop, much depending on the weather, whether a plant is obtainable or otherwise.

The stocking of the land as regards sheep is also very judiciously arranged; their presence on the farm during the winter months not being tolerated, but in summer a number sufficient to do the tenant yeoman service are grazed.

In the purchase of all the cattle, we saw that the fact that they would be to sell again had been kept in view. They were good-fleshed compact animals of nice weights, from 42 to 46 stones when fat, worth as much, or more, per stone than bigger beasts, and in the market attracting more customers. We were told that the heavier Norfolk turkeys are, the more are they worth per lb., but to cattle or sheep this does not apply in Norfolk more than elsewhere.

Mr. Devereaux's book-keeping is only meagre, and we should fancy he is more at home among the stock and work of the farm than wielding the clerkly pen; but Mrs. Devereaux is a useful assistant in the latter, and the two together have no difficulty in rendering intelligible how the financial part of the business stands.

He informed us that his capital when he started the farm was 500*l.*, and that, from what we saw, we could form some estimate of what it is now.

He is a Suffolk man from the estate of the late Sir Edward Kerrison, his father holding a farm of 150 acres there; and certainly the present owner of that estate is to be congratulated if Devereaux, Jun., is a fair sample of the sort of tenant it educates and sends forth.

Class IV.—Second Prize, 10*l.*

Edward Scrutton, Brandeston, Wickham Market, Suffolk.

	A.	R.	P.
Arable land	31	1	0
Grass land	16	2	10
Total	47	3	10

This farm is the property of Charles Austin, Esq., of Brandeston Hall, Wickham Market, and has been held by the present

tenant for 24 years, while his father occupied it for 40 years previously. The tenure is a yearly one, and no written agreement has ever existed between landlord and tenant. Rent 70*l.* per year, tithe rent-charge, 14*l.*, and rates averaging about 6*l.* yearly.

Mr. Scrutton does not live on the premises, farming being only a part of his vocation, he having a business at Brandeston village, about a mile distant, as wheelwright, carpenter, and timber merchant. His son, with his family, occupies the farm-house, but he also is engaged in the village business, and the farm is worked entirely by hired labour. The staff consist of 1 horseman, at 13*s.* per week; 1 labourer, at 11*s.* per week; and 1 boy, at 4*s.* per week. Extra payments for harvest are 8*l.* each man, less 4*l.* 16*s.* their weekly wages deducted. Extra help at harvest and after, 6*l.* This works out at about 31*s.* per acre.

The dwelling-house, now commodious and very comfortable, is pleasantly situated on the brow of a hill. The garden is well-stocked with young fruit-trees, interspersed with flowers, and in excellent order; and the latter remark will apply to the buildings generally.

Although the tenant is non-resident, the following account of the work done at his cost to the freehold will show that the owner has not suffered by the circumstances:—

	£	*s.*	*d.*
1863. Stubbing old fence and trees. New ditch and fence, 28 rods to Friday St. Field	4	10	0
1865. New bullock-shed and root-house, 27′ 6″ × 14′ 6″	14	10	0
One small gate, posts and pales to pond by pig-styes	4	5	0
Hog-shed and yard	3	10	0
Shed and boarded yard in meadow. No. on Plan 267	15	0	0
1872–3. Repairs to house, &c...	32	0	0
Cleaning stills, &c.	10	0	0
1878. Taking down old trees and stubbing old fence, filling up two ponds, and old ditch, 30 rods ..	5	5	0
1879. New fowl and coal houses at backyard of house, new pig-sheds and courtyards in Home Meadow	37	10	0
1882. Stubbing old fence and filling up ditches to stack-yard	2	0	0
1884. Making new footpath, carting gravel to same, 53 rods, filling up small pond and hacking up old footpath, stubbing old fence, filling up ditch, 7 rods	10	5	0
Part of carpenter's work to alterations and repairs to dwelling-house. Boxing out garden paths, planting fruit-trees and shrubs. Making and planting orchard with fruit-trees, filling up ditch	35	10	0
	£174	5	0

In addition to this, he has drained the whole of the land, some of it twice over, during his twenty-three years' occupation, partly with tiles, the rest with bushes, at a depth of 2 feet, and a cost of 216*l.*, making a total outlay on work, chiefly improvements, to 390*l.* 5*s.*

To show the good understanding existing between Mr. Scrutton and his landlord, and the unbounded confidence placed in him, we may mention that neither by any arrangement previous to the Agricultural Holdings Act, nor by observance of its forms subsequently, has he in any way endeavoured to protect himself against "disturbance" of tenancy, or repayment of the money he has spent in improving the farm.

The soil is a heavy but productive loam, on a subsoil of glacial clay, so retentive that, though drained at 15 feet apart, it is found necessary to cultivate on the 9-feet ridges already described in the account of the Commended farm in Class 3.

The cropping is a four-course one, viz.: (1) wheat; (2) roots and part fallow; (3) barley; (4) clover and beans.

Wheat, following clover and beans: farmyard-manure 10 to 12 loads are applied for it, and ploughed in 4 inches deep. This year the area in wheat was 6a. 2r. 10p., and the crop very good. The yield last year was 5½ quarters per acre, and we were told the crop was no better than that we saw.

Roots, which come after wheat, comprise this year 3 acres of mangolds and 1 of swedes, the cultivation for which is autumn and spring ploughings, dragging, &c., until fine; the land is heavily manured, 20 loads of farmyard-manure and 5 cwt. of artificials being given. It is deposited in ridges, covered by the plough. The seed sown for mangolds is 5 lbs. per acre, for swedes, 3 lbs., Messrs. Carter being the seedsmen. The plant was rather thin, but very healthy, wanting rain, which they got a day after our visit. The soil is too heavy for sheep, and the roots are all carted off in the autumn for consumption in the yards.

Part of the land after wheat is fallowed for barley, getting as many as seven earths, *i.e.* seven times moved by the plough.

Barley, this year about 9 acres in extent, is seeded with 9 pecks per acre, and sown as early as the weather will permit. The crop this year is most excellent. At our second visit it looked rather thin, but had gathered up wonderfully by the time we saw it again; 4 stones per acre of nitrate of soda had been applied, which doubtless helped it. The crop of the year previous averaged 46 bushels per acre, and Mr. Scrutton expected that he had more than that this year. He had sold last year at 35*s.* per quarter.

Seeds.—Chiefly red clover sown, and at the rate of 14 lbs. per acre, with a peck per acre of Italian rye-grass. The first crop

is mown for hay, and the second fed off. In May the plant was good, and promised well for a crop, which in July we found safe in a stack, and, from its size, the crop had been large.

Beans, which follow barley, have 15 loads of farmyard-manure spread on the barley-stubble, and ploughed in. This year 4 acres were spring-sown, and 1 acre was sown in the autumn, both being very fine crops.

The whole of the corn-crops on the farm were very good, and particularly clean. Couch-grass was not visible in any of the fields, and very little annual weed of any description. A small portion is bare-fallowed yearly, which certainly is not necessary as a weed-eradicator in this case; but Mr. Scrutton considers the aëration and exposure of the crude heavy soil to the sun so tends to increase its friability, that it pays him better in the end than continuous cropping.

Grass Land.—A small meadow-field of 3¼ acres, abutting on the River Deben, is mown yearly, but manure is seldom applied. Another field, upland, 8½ acres in extent, is mown and pastured in alternate years, farmyard-manure being applied after each mowing; but naturally it is a very poor subject, and its condition cannot be reported as anything out of the ordinary course.

Fences were very good; nearly all have been planted during the occupancy of the present tenant and his father. They are of nice height and width, trimmed yearly, as are also their borders, and give an air of neatness and finish to the clean and well-furnished fields which they bound.

Live-Stock.—The live-stock kept on the farm is as follows:—Two cart-mares, Suffolks, which do the necessary work and fill up their time in timber-hauling, and other odd jobs in connection with the village business. We also found two colts at our second and last visit. All their food is chaffed; 1 bushel of beans per horse per week, with a little bran added in spring and autumn, is their corn allowance.

Seven young bullocks are usually purchased annually and fattened off during the winter and spring months on roots and cake.

This year we found 21 lambs running on the grass, which would be summered and sold in the autumn, but Mr. Scrutton said he did not generally keep sheep stock.

The chief feature in the live-stock line are the pigs: 6 to 8 breeding sows are usually in stock; and their produce, averaging 100 annually, are reared, and fattened to the average weight of 10 stones each. All the beans grown on the farm are consumed by them, besides peas, lentils, and other feeding materials purchased. The food is given raw, but mixed with water 24 hours before being required for use, and by this means

slightly fermented when given. The breeding sows are daily grazed in paddocks, where they have sheds to retire to at pleasure. The fat pigs are sold in the locality by weight; and the sum received from this source between the 1st July, 1885, and the 1st July, 1886, amounted to 311*l.* 13*s.* 6*d.* Whether this does much more than cover the cost of food is doubtful, but it saves drafts on the pocket in another way; the manure merchant's bill being small indeed, and the fertility of the farm, which the excellence of the crops shows to be great, must be mainly dependent on the manure made by the pigs. But yet it is within the range of possibility that this may be bought too dear.

The actual profit made or loss sustained is, however, very difficult to come at, owing to the accommodation rendered by the farm to the business in the shape of horse and manual labour and produce, of which no account is kept; but the very superior way in which the farm is cultivated, combining cleanness of land with crops as heavy as it is desirable to grow with fences, gates, and buildings together in perfect order, with the great permanent improvements effected by Mr. Scrutton, well entitled him to recognition, and we had pleasure in awarding him the Second Prize.

Class IV.

Mr. William Webster, Stoke Holy Cross, Norwich.

Arable	66	acres
Pasture	15	„
Total	79	„

This farm, which is the property of Henry Birkbeck, Esq., of Stoke Hall, is situated 4 miles south of Norwich, and is occupied on a yearly tenancy, at the rent of 105*l.*, without restriction as to cropping or selling of produce; but his rotation, nevertheless, is the ordinary four-course one.

He paid a rent of 145*l.* before the commencement of the present troublous times, but received a reduction to that first mentioned, being about 28 per cent.

The soil on part of the farm is a heavy loam on a subsoil of clay, the other part a "mixed soil."

Wheat is sown after clover layers; 12 loads of yard-manure being ploughed in as a dressing for it, and 9 pecks of seed sown per acre.

Roots follow the wheat, and this year 12 loads of farmyard-manure and 1½ cwt. of nitrate of soda were applied per acre to the 6 acres of mangolds sown; and for swedes, 9 acres, the

same quantity of farmyard-manure, with 1 ton of bone-manure, sown over the 9 acres, was given.

Eighteen acres of barley, succeeding the root-crop, were dressed with 1 ton of nitrate of soda, spread over the whole.

The heavy land is cultivated on the 9-feet stetch, and roots, which came on part of it, were sown at our May visit.

The working staff comprised 4 men and 1 boy. The live-stock in November and July were as follows:—

November.		July.	
Cattle:—		*Cattle:—*	
Cows	14	Cows	9
Bull	1	Calves	3
	15		12
Sheep	10	Sheep	0
Pigs	21	Pigs	30
Horses:—		*Horses:—*	
Cart-horses	4	Cart-horses	4
Young horses	1	Young horse	1
Pony	1	Pony	1
	6		6

The cows are good milk-givers, the produce being made into butter, going weekly to Norwich.

We did not meet with anything in the way of stock or dairy management that calls for record, nor was the former in any of the classes of a very meritorious quality.

In May the barley looked fairly well, as did also one field of wheat, but Mr. Webster had been unfortunate with the other; it was a very thin plant, he being in doubt whether to plough it up or not, and, as is well known, "Nature abhors a vacuum," she had managed to fill the spaces between the wheat-plants with others certainly not of a rent-paying character.

We did not again visit the farm, being unanimously of opinion that it was out-distanced by the other competitors in the class.

We here desire to acknowledge the obligation we are under to the whole of the gentlemen competing for the Farm-prizes for the courtesy and hospitality which they accorded us on our visits of inspection, and the ready response that they made to our enquiries, both then and subsequently. Any other return but thanks it is not in our power to make, but our best thanks we beg them to accept.

Conclusion.

In our prefatory remarks, the deduction we drew from the Board of Trade Returns as to the cropping of the county was, that the rotation which took its rise in it, and has been so long known as "the Norfolk four-course System," is yet the predominant one; the same applying to Suffolk. Our observation extends only to the 14 competing farms, and therefore limited; their practice, however, in the main confirms the accuracy of these deductions; but a noteworthy fact which they exhibit is, that where they do deviate from the standard rotation, it is not, as might have been expected, in the direction of grass, but of corn. In almost every other district of the country at the present time the cry is grass, more grass, and the converse which holds here is probably owing to climatic influences. On the better class of soils, where 5 quarters of wheat and from 5 to 6 quarters of barley per acre can be grown, with root and clover crops equally satisfactory, it is by no means so clear, even with present low prices, that a change of rotation would materially benefit the Norfolk or Suffolk farmer. But on the thin light sands, on chalk, sand, or gravel subsoils, the case may be different, and a prolongation of the layers to two or three years might be found a great improvement. Nevertheless, in dealing with this or any other established practice that has taken deep root in a district, a departure from it should be deliberate and cautious. My own experience has been varied enough to deter me from falling into the mistake of condemning practices which I find in one part of the country, merely because they differ from others that are successful in another; and I cannot doubt that the many able and enlightened agriculturists now in practice in Norfolk will fully maintain its ancient prestige. Whatever rotation, under present circumstances, experience may prove to be best, they will now, as in the past, prove equal to the occasion, and be prompt in their adoption of it; and with the good wishes of my colleagues and myself for their success in whatever change of front they may find essential, I beg to make my bow on behalf of us all.

XXIII.—*Report of the Senior Steward of Live-Stock.* By Alfred Ashworth, of Tabley Grange, Knutsford, Senior Steward.

The forty-seventh Country Meeting of the Royal Agricultural Society of England, held at Norwich, under the Presidency of H.R.H. The Prince of Wales, will rank as one of the most

successful in the history of the Society. In this remark I am speaking as a Steward of Live-Stock, not of Finance.

This is the second visit of the Society to Norwich. In 1849 the Show was held in the grounds of Mr. Gurney, on the Ipswich road; but the present increased requirements of the Society rendered this position impracticable, and the Local Committee had to look elsewhere. Mr. Colman, M.P., of Carrow House, came to the rescue, and most generously placed his beautiful Park at Crown Point at the disposal of the Society.

Mr. Colman's assistance did not end here; much had to be done in the way of pulling down buildings and widening roads and bridges, which he willingly undertook. These improvements were carried out under the most able direction of his agent, Mr. Garrett Taylor, with the result that, at the date appointed, one of the most convenient and perfect Show-grounds was handed over to our Surveyor, Mr. Bennison, in which to erect his encampment of some five miles of shedding —and rarely, if ever, has he had so pretty a spot. Bounded as it is by fine timber on three sides, with the river at its foot, and looking across to the picturesque hamlet of Thorpe, it is a site of singular beauty and appropriateness.

The return to the practice of opening the entire Show-ground on Monday, instead of Wednesday, as at Preston last year, gave great satisfaction to those in charge of the stock, as affording a day of rest after in many instances a long night journey.

The interesting Sunday service was held as usual in the large tent; and the Bishop of Norwich was attentively listened to by a large congregation of the men employed in the Yard.

Punctually to the minute, at nine o'clock on Monday morning, Mr. Jacob Wilson, as Steward of General Arrangements, had finally dismissed the various Judges, who had previously been assembled in the large tent, to their respective duties.

That enemy of the "Royal" was soon in attendance, and Monday's judging took place amidst a downpour of rain, which will long be remembered by those who were on duty.

The following Table shows the daily attendances, &c., as compared with the corresponding days at Preston last year:—

	Norwich.	Preston.
July 10 (2*s.* 6*d.*, Implement Yard only)	148	394
„ 12 (5*s.* 0*d.*, Implement and Stock Yards) ..	625	3,557
„ 13 (2*s.* 6*d.* „ „ „) ..	8,074	21,713
„ 14 (2*s.* 6*d.* „ „ „) ..	10,894	19,318
„ 15 (1*s.* 0*d.* „ „ „) ..	42,774	34,302
„ 16 (1*s.* 0*d.* „ „ „) ..	42,394	14,908
Total	104,909	94,192

The week was showery, but the nature of the soil was such, that it soon dried up, and was never anything but "good going." The following remarks on the live-stock are only cursory and general, and I leave the detailed report to abler hands appointed for that purpose. The advance which has taken place in the fashion of exhibiting stock (and I hope I may say in agriculture also) is well shown by taking a glance at the Catalogue of the previous Show of the Society held at Norwich in 1849, a county which then claimed to take the lead of all others in agriculture.

In 1849 the total entries of stock were 624 as against 1825 this year, and moreover the classes and breeds exhibited were much fewer than they are now.

For example, in 1849 there were only two classes of Cart-horses, viz. Agricultural and Dray Horses, and there was one class for Roadsters and Stallions. Then in cattle, sheep, and pigs it will be seen by the following Table that there were only nine classes, as against twenty-seven now.

CATTLE.

1849.	Entries.	1886.	Entries.
Shorthorns	95	Shorthorns	82
Herefords	28	Herefords	73
Devons	48	Devons	28
Any other breed	39	Sussex	41
		Welsh	25
		Red Polled	146
		Jersey	187
		Guernsey	41
		Any other breed	41
		Dairy Cattle	17
	210		681

SHEEP.

1849.	Entries.	1886.	Entries.
Leicester	106	Leicester	18
Southdown	82	Cotswold	30
Long Wools	33	Lincoln	21
		Other Long Wools	23
		Oxford Downs	62
		Shropshires	97
		Southdowns	114
		Hampshires	35
		Suffolk	34
		Other Short Wools	6
		Cross-breds	6
	221		446

PIGS.

1849.	Entries.	**1886.**	Entries.
Large	45	Large Whites	40
Small	42	Small Whites	25
		Middle Whites	31
		Small Blacks	32
		Berkshires	54
		Tamworths..	21
	87		203

But to come to more recent times, we find the entries at Norwich larger than any year since Kilburn, 1879, when the Show was International.

The following tabulated statement shows the present number of entries in the stock division, in comparison with those made at five previous years:—

	Norwich, 1886.	Preston, 1885.	Shrewsbury, 1884.	York, 1883.	Reading, 1882.	Derby, 1881.
Horses ..	495	438	407	611	239	256
Cattle	692	539	579	462	598	392
Sheep	448	433	490	412	442	414
Pigs	205	203	211	200	188	167
Total ..	1825	1613	1687	1685	1467	1229

Some of this increase may be due to the fact that "post entries" are now permitted, and to what extent Mr. Jenkins would of course be able to say.

To further examine these figures it is instructive to note from what counties they come.

Norwich is in that subdivision of England known to the Council as the A. division. This comprises Bedford, Bucks, Cambridge, Essex, Herts, Hunts, Middlesex, Norfolk, Oxford, and Suffolk; and I find that this division supplied the large proportion of 857 exhibits out of the total of 1825, and in the proportions shown in the list on p. 668.

It will be further seen from that list, that out of the 857 exhibits supplied by this A. Division the counties of Norfolk and Suffolk contributed 623; of which 497 were made up of *Suffolk Horses* and *Red Polled Cattle*, and these two breeds formed a most prominent and handsome feature of the Show.

The Suffolk horses numbered 91, and though they can boast of a very ancient pedigree, which seems to be borne out by their uniformity of type and colour, still they seem to have remained

A. Division.

Counties.	Horses.	Cattle.	Sheep.	Pigs.	Total.
Bedford	7	2	6	6	21
Buckinghamshire ..	..	6	15	..	21
Cambridge	16	5	26	2	49
Essex	21	20	13	4	58
Hertfordshire	..	13	6	..	19
Huntingdonshire ..	12	..	4	..	16
Middlesex	10	21	1	..	32
Oxford	1	..	17	..	18
Norfolk	134	143	69	12	358
Suffolk	136	84	24	21	265
Total ..	337	294	181	45	857

peculiarly local; for, with the solitary exception of one from the adjoining county of Essex, the whole of the entries came from Norfolk and Suffolk.

The same remark applies to the Red Polled cattle, 146 entries, and grand cattle they were; all came from Norfolk and Suffolk.

Contrast this with the Shire horses and Shorthorn cattle, which are thoroughly cosmopolitan; there were comparatively few entries of either, still I find the 85 "Shires" hailing from eighteen different counties, and over a score of counties contributing to make up the meagre entry of 82 Shorthorns.

The Jersey entries numbered 187, and they, with the 41 Guernseys, formed numerically one-third of the entire show of cattle. This number has not been equalled except at Kilburn in 1879, when they reached the large total of 252, and such an entry may well elate the admirers of these breeds. It is well, however, for them to bear in mind that they are not yet to be found amongst the large dairies of Cheshire and Derbyshire.

Their milk is rich, and they are looked upon as luxuries, but they have as yet a want of substance and robustness which appears to prevent their being generally useful to British agriculturists.

The two Dairy Classes were poorly filled; in fact, they were a failure, for only one cow complied with the very severe conditions as to milking and quality of milk, and there was only one heifer shown in the other Class.

Nevertheless, these Classes seem to me to be a step in the right direction, and deserve the further attention of the Society. The scarcest thing in our large towns is cheap good milk, and the Society will do well to encourage its production.

In sheep, as usual, the Shropshires took the lead, numbering 97 exhibits. They appear to be widely distributed, coming from Lancashire and all the midland counties; oddly enough, the one which gave them their name only supplied 25 exhibits.

But if this is curious with "Shropshire" sheep, it is doubly so with "Berkshire" pigs; they numbered more than one-quarter of the 205 pig entries, and though coming from nine different counties, the Royal county of Berkshire was conspicuous by being unrepresented. I must not pass over the "Thoroughbred Stallions suitable for getting Hunters." Eight entries, but only 6 put in an appearance—a Class quite unworthy of a National Society. It is, however, to be hoped (and may reasonably be expected) that the effort the Society is making in holding a preliminary Spring Show at Newcastle, and giving substantial prizes, will not only bring the right animal out, but will place him within reach of farmers.

The Poultry Show was again held, though I am sorry to say with fewer entries than at Preston. The prize list is liberal, the pens are large and well appointed, and the entrance fee is very small, and yet there appears to be something wanting to make it attractive to exhibitors of Poultry.

The last of the "Live Stock" to be noticed are the Bees. The daily "drivings" attracted much interest, and were honoured. by a visit from Her Royal Highness the Princess of Wales.

The Working Dairy absorbs more interest every year, and is becoming one of the most instructive sections of the Show. Sir John H. Thorold is the Steward of this department, and it was opened to the public on Saturday with the Implement Yard.

It will be remembered that at Kilburn the "Separator" was first introduced; it is now considered indispensable to a large dairy.

This year Mr. Pilter, of Paris, through the Dairy Supply Company, exhibited a machine called a Délaiteuse, for separating the buttermilk from the butter, after being taken out of the churn, and it appeared to do its work quickly and effectively. During the lectures given by Miss Smithard, and the making of French soft cheeses under the direction of a French expert, the Dairy and its surrounding were crowded; and I would venture to suggest, if not trespassing out of my province, that moveable stands should be placed round the Dairy similar to those at the horse ring during parades, so that those who are unable to obtain seats, or unwilling to pay the extra charge for them, should still be able to see what was going on.

H.R.H. the Prince of Wales, in graciously accepting for the third time the arduous post of President, did not shirk its duties, but gave practical assistance by his regular attendance at the Council meetings in Hanover Square, and by visiting the Show-ground during its preparation, attended by Mr. Jacob Wilson, the Steward of General Arrangements.

His Royal Highness, moreover, paid three visits to the Show during the week it was open, and on two occasions was accompanied by the Princess of Wales and the Princesses.

Our friends the Colonists, at the request of His Royal Highness, were not overlooked. Mr. Jacob Wilson placed at their disposal a "reserved" portion of the "Grand Stand," and the Council entertained them at a luncheon presided over by Sir John H. Thorold, Bart. They were also most hospitably received at Carron House by Mr. Colman, M.P., and were afterwards shown over his extensive and interesting works.

The ancient city of Norwich was handsomely decorated, and received the Society with a hearty welcome and great hospitality.

To the Mayor, Mr. Gurney, and to the Local Committee the greatest praise is due for their zealous co-operation with the Society.

The Great Eastern Railway Company, at whose mercy we found ourselves, deserve our best thanks. Quite exceptional difficulties, entailing a large outlay of money, were met and overcome by them; and the exhibits were most promptly received and delivered into the Show-ground; and much credit and thanks are also due to their most able manager at Crown Point.

The conduct of those employed in the Show-ground was very good, only one case of drunkenness having been reported to the Stewards during the whole week; while the A. Division of Police, who were as usual in attendance, stated they had never had a more orderly crowd of visitors to handle.

It is my pleasant duty to thank Mr. Garrett Taylor, our most active Steward of Forage, for his great services, and I do so very heartily. Mr. Taylor not only most efficiently filled the duties of his office, but was constantly appealed to, and was always to be relied upon, to give help wherever it was wanted. I do not forget also to acknowledge the value of the work done by our most energetic Assistant-Stewards, Messrs. Beck, Greenwood, Cobbett, and Fair, to whom in a great measure the success of the parades was due.

My predecessors, I note, have generally recorded that they look back upon their four years' stewardship as a period of great bliss. Whilst sharing in some degree this feeling, I cannot go quite so far. The duties of the office are instructive, and give one an insight into the ramifications of our National Show; at the same time they entail a vast amount of detail and anxiety, and have led me to look upon our Steward of General Arrangements with increased respect, but not with covetous eyes at his office. What I do, however, look back upon with unalloyed pleasure is the companionship of my brother Stewards, and the kindness and willing assistance given whenever required by the officials of the Society; and to each and all of these I beg to tender my sincerest thanks.

XXIV.—*Report on the Exhibition of Live-Stock at Norwich.* By Sanders Spencer, of Holywell Manor, St. Ives, Hunts.

It was generally feared that many causes might operate to render the Norwich Meeting less of a success than one now appears to look for at a Show of the Royal Agricultural Society. It was suggested that Norwich was quite on one side of the country; that the means of access by rail were not of the best; that the county of Norfolk was more a winter-grazing than a stock-breeding district; that the ten "lean years" had caused such a serious and general depression in agricultural circles, as to limit the number of aspirants for show honours; and that the population was so sparse that the number of visitors would be much fewer than usual. Fortunately these sad forebodings were not realised. The 1886 Show will hereafter be referred to as one of the most successful of the Society's Meetings. The number of entries was in excess of any Show since the International one at Kilburn, as will have been seen by reference to the Table on p. 667.

Some of the principal causes for this welcome success are not far to seek. The most powerful factors undoubtedly were the complete and courteous manner in which our Royal President carried out the many and arduous duties connected with his office; and the gracious patronage accorded to the Show by their Royal Highnesses the Prince and the Princess of Wales, whose presence with their family on the Tuesday, Wednesday, and Friday of the Show gave not only the Norfolk people still another opportunity of showing how highly they appreciate the honour of their county being selected for the "country home" of our future sovereign, but to thousands of agriculturists from all parts of the British Isles who were still more anxious to give expression to the universal feelings of love and admiration brought into being by the long-continued interest taken by their Royal Highnesses in all that pertains to the homes and farms of those of their future subjects who are connected with agriculture. The site of the Show was all that could be desired; those members of the Society who attended Norwich doubtless felt how much they were indebted to Mr. Colman for the use of his Park. The railway arrangements were excellent, and the hospitality of the city authorities was profuse; but this and many kindred subjects I must leave to the pen of the courteous Senior Steward, whose duty, if not pleasure, it is to write a valedictory report.

HORSES.

It was scarcely to be expected that the horses would be so numerous at Norwich as at York three years since, nor was it for a moment supposed that, with this exception, the entries of Horses this year should exceed those of any of the previous six years. Indeed, there were nearly as many specimens of the equine breed entered at Norwich as at the two meetings of Reading and Derby. Uncomplimentary comparisons have recently been made of the numbers of entries in the Horse Classes at the Royal and at some other Shows; but a most important fact has been omitted, that at the Royal an animal can only be entered in one class, whilst at some of the Shows mentioned the same animal may be, and sometimes is, entered for competition in three classes, and a separate number given to it in the catalogue for each class; thus an argument founded on these figures is fallacious and misleading. The breeders of the Norfolk Hackney (a horse which appears to have found a very warm place in the hearts of our "American cousins") were most successful in their efforts to bring their favourites before the public. Some grand specimens of the breed appeared, especially in the classes for the younger animals. The impressiveness of the best sires of the breed was also most marked—a proof that they have been bred to points for many generations.

Shire Horses.

There is not the slightest doubt that the large and successful exhibition of Shire horses held in the spring each year, under the auspices of the Shire Horse Society, very materially affects the number of entries at the Royal. Many of the young stallions and fillies, which looked almost perfection when at home, had been tried in London, and found not to be those almost perfect animals which they were thought to be by their owners. A still stronger reason for the comparative paucity of entries is the great objection entertained by breeders of horses to have their breeding animals in training for Shows at a most critical period of the year. Still, with all these drawbacks, the Shires at Norwich made a most creditable display. The home county came out strong, and not only won both Champion prizes, but also had the credit of producing the Champion Stallion, a splendid black colt, "Julian," bred and exhibited by Mr. T. Brown. "Julian" was successfully shown at Norwich in the spring, when his fine bone and hair and his jaunty action created a crowd of admirers. The colt has since furnished and improved so very much, that the Judges had no

hesitation in declaring him to be the best male Shire in the Yard. It was rather hard on "Hatherton," a very heavy and stylish bay, with any amount of bone and muscle. His owners, the Cannock Agricultural Company, had evidently not saved this colt for show purposes, but had caused him to earn his living during the season. In the absence of Lord Ellesmere's first-prize London winner, the first prize for Two-year-old Stallions was awarded to the massive "Hitchin Emperor," which, when a yearling, cost his owner, Mr. H. Browne, 250 guineas. An improving colt, "Real Briton," the property of Mr. Walter Gilbey, was placed second; this colt now needs the rest he has fully earned by his many successes in the various Show-rings. The third prize was given to Lord Ellesmere's "Shrewsbury," a colt which was unbeaten as a yearling. An enormous colt, closely related to the extraordinary and noted mare "Chance," was shown by Mr. T. H. Miller, and took reserve and highly-commended tickets. The Yearling Colts, few in number, included some promising youngsters. As in most other classes for young stock, the positions of the prize-winners are changed from those taken at the previous Shows. At the London Show, Mr. J. Rowell's "Premier Prince" was placed first, now he wins third; whilst the grandly-bred "Brother Glow," the property of, and bred by, Mr. Walter Gilbey, now takes first prize in lieu of the barren honour of reserve and highly-commended. This change was not unlooked-for by good judges. Nine Mares with Foals were entered, but several of them were absent. The Earl of Ellesmere's well-known "Lady Lincoln," bred in Derbyshire, was an easy first; the three others noticed by the Judges being fully entitled to the honour. The first-prize three-year-old, belonging to Colonel H. Platt, was also reserved for the Champion Cup. This is a very fine filly, of enormous substance, but she has not altogether escaped from the effects of early forcing; she won second prizes at Preston and at the 1886 London Show. At least four other good fillies were noticed by the Judges.

The Earl of Ellesmere's active black filly took the first prize in the Class for Two-year-olds, being followed by two very good ones shown by Mr. A. H. Clark and Mr. W. Gilbey. To Class 33 belonged the honour of furnishing the winner of the Champion Prize of 25*l.*, offered by the Shire Horse Society for the best Mare or Filly exhibited. It was a source of pleasure to every one that the year of the Presidency of H.R.H. the Prince of Wales should be marked by the great success of a Shire mare from the Royal Farm at Sandringham. It was generally admitted that the splendid black mare "Jewel" was fully entitled to the high position which she took, and that the fine condition

in which the mare was exhibited reflected great credit on the respected manager of the Royal Farms in Norfolk. Two grand mares and great prize-winners, Mr. Walter Gilbey's "Chocolate," and the Hon. E. Coke's "Czarina," were placed second and third, high commendations being given to two other good mares belonging to Mr. W. Welcher and Mr. J. S. Nunn.

Report of the Judges on Shire Horses.

CLASS 1. *Shire Stallion foaled in* 1883.—Sixteen entries, three absentees; fair class. First prize (and also Champion as the best Shire Stallion in Classes 1, 2, and 3) was awarded to No. 15, a good-looking black, with fine action, the right sort of bone, and splendid feet and hair. Great credit is due to his owner and breeder for retaining such a horse in the county. Second prize to No. 12, a stylish bay, looking the worse for his season, but with good bone and substance; third prize to No. 8, a grey, with capital feet and hair.

CLASS 2. *Shire Stallion foaled in* 1884.—Twenty-two entries, many absentees; a good class. First prize to No. 34, a dark brown, with great substance, and all over a cart-horse; second prize to No. 37, a bay of nice quality; third to No. 25, a bay brown, of good character and type.

CLASS 3. *Shire Stallions foaled in* 1885.—A small mixed class.

CLASS 17. *Shire Mare and Foal.*—A small good class of four entries. First prize to No. 190, a brown, of remarkable substance, and all over a brood mare; second prize to No. 185, a black short-legged mare of good quality; third prize to No. 192, a very nice bay, shown under great disadvantage.

CLASS 25. *Shire Filly foaled in* 1883.—Seven entries; a medium class. The winner, No. 252, a well-grown bay mare, with plenty of quality.

CLASS 26. *Shire Filly foaled in* 1884.—Nine entries. First prize to No. 246, a good moving black, with capital feet and hair, but lacking substance; second prize to No. 265, an improving grey.

CLASS 33. *Shire Mare foaled previous to the year* 1883, *not having a foal at foot.*—Seven entries; a very good class, all receiving notice. First prize (and also Champion prize as the best Shire Mare in Classes 17, 25, 26, and 33) to No. 323, a black, and quite a brood mare.

WM. LITTLE.
J. B. HILL.
T. S. MINTON.

CLYDESDALES.

The grand display of Clydesdales, one of our best and most noted varieties of draught horses, was a source of great pleasure as well as of surprise to visitors to Norwich. I scarcely expected that it would be my duty to report of the Clydesdales that they made one of the best collections seen during recent years in the Royal Showyard, and that in some of the classes the exhibits were of such a high order of merit that the Judges might with ease have selected a second lot of animals fully deserving a place in the prize-list. In the Class for Three-year-old Stallions the first-prize winner did not appear to have such good ancles and flat bone as Mr. G. Rodger's "Little Jock Elliott." The legs and feet, as well as the hind action of the Marquis of

Londonderry's "Vanguard" were good, but the most improving colt in this class appeared to be Mr. J. Kilpatrick's "Knight of Ellerslie," a bay, full of quality and style; he had lost his hair somewhat, this gave his splendid flat legs an appearance of lightness. In the next class, Mr. A. Montgomery had an easy win with his two-year-old colt, "Mac Phail," a grand mover, with the best of legs and feet, and a rather plain head not improved by a bald face. The second-prize winner, Mr. G. Rodger's "Warpaint," had also a plain head (said to be an indication of future size and substance of its possessor), well-sprung ribs and springy action. The Duke of Portland's "Holyrood" was a very promising colt, but of a bad colour. The Yearling Colts were few, yet a splendid lot. Mr. A. Montgomery's stud again supplied the winner of the first prize; this was a most promising brown colt, fully deserving his high position. The winner of the second prize, the Marquis of Londonderry's brown colt, is also a very good one, but requires time to develop. The Rev. John Gillespie and Mr. R. W. Nunn won the third prize with "Gilbert Glossin," another brown colt likely to prove a success at the stud and in the Showyard. The Clydesdale Mares with Foals were a fine collection. The third-prize winner, "Violet," from the Royal Sandringham Farm, has an interesting history, as she was presented to H.R.H. the Prince of Wales by the late Mr. Drew, on the occasion of His Royal Highness paying a visit to Merryton some seven years since. The first- and second-prize mares, shown respectively by the Duke of Portland and Mr. C. J. Lucas, were two splendid specimens of a breed which has representatives in almost every country to which British stock have been exported. The Three-year-old Fillies were very good, and the beautiful short-legged bright bay, shown by Mr. D. Riddell, was undoubtedly the best, although the Duke of Portland's "Loyalty," with her nicely turned hind-quarters, had many admirers. A very active filly, mayhap a trifle high on the leg, took the third prize for Mr. A. Pease. The Marquis of Londonderry's fine filly, "Gracie," was reserved. The best two-year-old was the Earl of Cawdor's "Dewdrop," a bay with four white legs, flat bone, and good feet, her action was nearly perfection. There did not appear to be much to choose between the Duke of Portland's "Dagmar" and the third-prize winner "Stella," bred and exhibited by the Marquis of Londonderry.

Agricultural Horses other than Shires, Clydesdales or Suffolks.

During my survey of the horses I chanced to meet with one of our most successful breeders of stock, whose practice has

been to decline to use as a sire a male animal, however good it might be, unless he could trace its pedigree or breeding. His first enquiry was as to the benefit it was possible for any person to derive from the offering of the eight prizes of the value of 100 guineas in the three classes for nondescripts. "To begin with," said he, "there are only eight entries for an equal number of prizes, and if one leaves out the three first-prize winners, the less said of the classes the better; except, perhaps, of the winner of the third prize in the Class for Stallions; this horse was so exactly like one which was shown at the 1885 London Shire Horse Show, in the Three-year-old Class, and at the last Norfolk Spring Show as a Shire, that he felt compelled to ask himself how it could be eligible for the class in which it is now shown." Many other persons asked themselves the same question, to which the owner of the horse will doubtless be able to give a satisfactory answer. The first prize in Class 11 was won by a magnificent stallion shown by Mr. D. Riddell —"Prince of Avondale," which was bred by the late Mr. L. Drew; he is a beautiful mover, of a good colour, and has legs as hard as iron, feet and hair grand, and has the head and appearance of a stallion, yet is as kind and playful as a kitten. The only Mare with Foal shown in Class 20 was a splendid brown, and one of the grandest mares seen of late; she is the property of Mr. W. R. Trotter, who has failed to discover her breeder, but she is evidently a cross between the Clydesdale and the Shire Breeds. Lord Hastings must have been possessed of *hope* and *faith* when he sent "Charity" to compete in the Class for Three-year-old Fillies. On this occasion "Charity" was not only credited, but rewarded with a first prize for her good action, and her other qualities.

Report of the Judges of Clydesdales and Agricultural Horses.

Regarding the Clydesdales as a whole, we have to report that, notwithstanding the distance of the Show from Scotland, and from the localities in England where studs of that breed are situated, they are not only good in themselves, but as good a representative of the breed as was ever seen at any Exhibition of the Royal, the Kilburn Show excepted.

Eight *Three-year-old Stallions* were exhibited in Class 4. The four horses to which the prizes were awarded are very good, the first and second ones specially so, there being rather a close tie between them. The first-prize one, No. 55, had the advantage of the second, No. 48, in moving more freely, and in being more evenly balanced all over; but the latter was better in his hocks and hind pasterns than the former.

Class 5.—There were ten horses exhibited in this class, and here, again, the first four are good horses of nice quality. The first-prize horse, No. 60, has nice quality of bone, feet, and hair, and moves well. The second, No. 57, also moves well. Besides not being in such good bloom as the first, he is altogether a plainer horse. The third-prize horse, No. 67, a roan, has great

substance, but he is too wide in his hocks, and moves only moderately well. The animal to which the reserve ticket was awarded, No. 66, is a fairly good horse. The remaining animals in this class are not possessed of special merit in any way.

Class 6.—Of the seven entered, five were forward, and on the whole the class was a good one. The first-prize animal, No. 69, is a big, level, good horse, with first-rate bone and feet. He seems likely to grow into a very good horse. The second-prize horse, No. 70, is also a good one, with excellent bone and feet, but he is low in his back. The third and reserve horses, Nos. 74 and 73, are also excellent specimens of the breed.

In Class 11—*for Agricultural Stallions, not qualified to compete as Shire, Clydesdale, or Suffolk*—the first-prize horse, No. 124, is a very good one. He moves beautifully, has good bone, and is well put on his legs. The animal to which the second prize was awarded, No. 120, is a fair horse, a description also applicable to No. 121, to which we recommended that the third prize, of 5*l.*, should be awarded.

Class 18. *Clydesdale Mares with Foal at foot.*—Of the five exhibits in this class the first-prize one, No. 201, is a mare of good quality, sound, and a capital mover. No. 197, to which the second ticket was awarded, has also good action, but in her fore-feet and pasterns she is inferior to the mare placed before her. The third mare, No. 195, seemed to have been a good one, but she is getting stale. The remainder were only moderately good.

There was only one mare shown in Class 20, *for Agricultural Mare and Foal not qualified to compete as Shire, Clydesdale, or Suffolk.* She is an excellent one, and quite fit to win in good company. We had no hesitation in recommending that the first prize of 20*l.* should be awarded to her, as we considered her well entitled to it.

Class 27—*for Three-year-old Clydesdale Fillies*—which contained five animals, was on the whole a very good one, the three animals to which the money-prizes were assigned being specially good. The first-prize one, No. 271, was a clear winner. She is altogether a very good young mare, showing nice quality and much symmetry, and her bone and feet are excellent. The filly placed second, No. 272, is also an excellent one, with capital feet and pasterns, but she does not move so well behind as could be desired. The third one, No. 267, is a big, upstanding mare, whose bone and feet are good, but she might move better.

Class 28. *Two-year-old Clydesdale Fillies.*—This was altogether an excellent class. The two best in the class are specially good, while the next couple in order are also very meritorious. The first-prize filly, No. 280, is a remarkably-level sweet filly, and moves beautifully. Her bone and feet are exceptionally good, and altogether she is fit to compete in the best of company. The second, No. 283, is a nice symmetrical filly, with excellent feet and legs, which she uses well.

Class 32.—Only one mare exhibited, a very good one.

Class 35. *Four-year-old Draught Geldings.*—This class, comprising three animals, is only moderately good, and the Judges regret that they cannot speak more favourably regarding it.

James Cunningham.
Andw. Ralston.
Richard Machin.

Suffolks.

In the carefully-written and valuable Report on the Live-stock exhibited at the Shrewsbury Royal the first paragraph under the heading "Suffolks" runs thus :—" Far from home is the plea

in excuse of shortcomings in the Suffolk classes." That this was no idle excuse is amply proved by the admirable display of Suffolk Punches at Norwich. Each class was well filled with good representatives of the breed, which continues and promises to continue in favour with many East Anglian farmers. The breeders of Suffolks had evidently taken advantage of this, their most favourable opportunity of bringing their active and showy horses before the notice of both home and foreign agriculturists. It will be observed that the Judges were most favourably impressed with the high quality and careful breeding of the numerous prize winners, of which they have given such an exhaustive and interesting Report, that there remains for me comparatively "no work to do." One sometimes hears it remarked by those who are unable to appreciate the many good qualities of the Suffolks, that only a limited number of persons are at the present time paying attention to their breeding. Such an assertion is easily refuted by examining the list of the names of the owners of those chestnuts which have been honoured by the Judges. I was surprised to find that no fewer than seventeen different gentlemen successfully exhibited Suffolks at Norwich. These were the Duke of Hamilton, the Marquess of Bristol, R. Edgar, M. Biddell, W. Wilson, A. J. Smith, R. E. Lofft, I. Pratt, H. Wolton, W. Byford, S. Toller, C. Austin, R. Flick, N. Catchpole, R. Capon, R. H. Wrinch, and D. A. Green, all of whom reside in Suffolk. There is but little fear of a distinct breed of stock not making headway whilst it has so many and such influential admirers.

Report of the Judges of Suffolk Horses.

Beginning our Report of the show of Suffolk Cart Horses, we can confidently say, without hesitation, that no better show of Suffolks was ever seen at the Royal. The classes were all well filled, most of them with many animals of considerable merit.

Class 7.—No. 82, a fine up-standing horse, with famous feet and legs, moved remarkably well, we thought well deserved first honours, and he was afterwards awarded Champion Prize for the best Suffolk Stallion; No. 84 stood well for second prize, a good type of Suffolk horse; moves very freely and well; No. 87, third prize; No. 78, reserve. Whole class commended.

Class 8.—No. 98, a compact level colt, very fair mover, had first prize; No. 95, second prize, well made, with capital action; No. 91, big useful colt, third prize; No. 99, reserve and highly commended.

Class 9.—A very good class, all highly commended. No. 102, fine well-grown colt, one that made a good reserve for the Champion Prize, and easily took first in his class; he looks like coming to a remarkably-fine horse. No. 108, very well made, second prize; No. 100, third prize; No. 101, reserve and highly commended. This class we thought worthy of high commendation.

Class 10.—This class was, perhaps, not quite up to the standard of the

preceding one. No. 112, placed first, is a very lengthy growing colt; No. 117, second; No. 113, third; No. 118, reserve.

CLASS 19.—Eight out of nine entries for Mares and Foals appeared before the Judges, the first three of which were very superior animals, brought out in the finest condition, and such as the county of Suffolk may be justly proud of. No. 204, first; No. 206, second; No. 209, third; No. 211, reserve.

CLASS 29.—No. 294, a very good filly, long, low, and level, showed well for the Champion Prize, but had to succumb to the older mare in the preceding class, it took first prize; No. 292, second prize, very big, well-grown; No. 296, third; No. 295, reserve.

CLASS 30.—No. 298, first prize, a very smart filly, good type of a Suffolk; No. 308, second prize, good filly, big, long, likely to make a good brood mare; No. 307, third; No. 300, reserve, a very smart filly. Whole class commended.

CLASS 31.—No. 311, first prize, a long useful filly; No. 315, second; No. 318, third; No. 314, reserve.

CLASS 34.—No. 330, first prize; No. 336, second; No. 335, third; No. 331, reserve. All useful animals.

Champion Stallion, No. 82; reserve, No. 102.

Champion Mare, No. 204; reserve, No. 294.

WM. THOMPSON.
THOMAS GIRLING.
J. E. CHAPMAN.

HUNTERS.

This department of the Royal Show has generally been somewhat weak. Many reasons have been given for this unfortunate state of affairs, but perhaps the principal cause is the great length of time the animal is compelled to remain in the Royal Showyard under conditions not the most conducive to its continuance in the high condition necessary for success in the showyard. Again, there are at the present time so many local shows of one day's duration, whose managers endeavour, by offering liberal prizes for hunters and leapers, to secure the attendance of the public. The fondness for a horse seems to be almost a part of an Englishman's nature. It is hoped that the very liberal and judicious changes made in next year's prize-list will be of immense benefit to all interested in the breeding of hunters. Only six of the eight Thoroughbreds entered put in an appearance. The first prize was easily won by the splendid grey "Scot Guard," the property of the Duke of Hamilton. There appeared to be some question as to whether or not the second- and third-prize winners should not have changed places. There is not the slightest doubt that at the present time we must, in the grass counties, have hunters which can go the pace; yet it is equally necessary that in a flying country one's mount should be able to land safely, and for this end good fore-legs and oblique shoulders are necessities. The Class for Hunter Mares and Foals contained some very promising stud

matrons and youngsters, the winning exhibits of Mr. E. G. C. Bomford and Major F. H. Thwaites being especially good. The third-prize winner, the property of Mr. A. W. Jarvis, had one of those pedigrees which "no fellah can understand," viz., "breeder unknown, sire 'Theobald,' dam by 'Seabreeze.'" How is it possible to certify the pedigree of an animal whose breeder is unknown? This weakness of giving a pedigree with the remark of "breeder unknown" is happily almost confined to the classes for hunters. In the Class for Heavy-weights are four entries, and in that for Four-year-old Geldings three entries, with pedigrees given, yet the breeders are stated to be unknown,

Amongst the Weight-carrying Hunters were several old favourites, whose points are so well known to all who are fond of a good horse that it is scarcely necessary for me to attempt to describe the prize-winners, which were Mr. J. V. Keevil's fine quality and powerful bay "Norseman," Mr. J. Pallister's "Brancepeth," and a black gelding bred in Norfolk and shown by Mr. A. C. Fountaine. In the Class for Light-weights, three old and and well-tried favourites made good their claim to winning honours. Of the nineteen Four-year-old Geldings entered, the best was a very neat and stylish brown, shown by Mr. F. W. Burdock; but he was closely followed in point of merit by Mr. J. T. Mills's "Red Deer" and Colonel Barlow's "Kildare." In the remaining four Classes there were only twenty-three entries for the twelve prizes offered, a result which does not surprise those who were aware of the fact that comparatively few Hunters are bred in the Eastern Counties. The three-year-old filly "Princess Beatrice," bred and exhibited by Mr. F. Blenkin, and the two-year-old filly "Pantheon," the property of Mr. C. C. Hayward, fully deserved the high eulogiums passed on them by the Judges.

Report of the Judges of Thoroughbreds.

Class 12.—Thoroughbreds more adapted for getting hunters than have appeared for some time.

Class 21.—Mares and foals a fair good class.

Class 36.—A good class.

Class 38.—A good useful class.

Class 39.—No comment.

Class 40.—Good.

Class 41.—One mare, No. 400, of special merit.

Class 42.—Poor class, with the exception of the first prize.

Colonel Rivers Bulkeley.
John Blencowe Cookson.
Chris. B. Robson.

Hackneys and Ponies.

Members, exhibitors, and all readers of the Society's 'Journal' are alike indebted to the Judges of the Hackneys and Ponies for their most able Report. This is so complete, concise, and instructive, and its conclusions so entirely in accord with those which I had formed after a careful survey of the animals in the different classes, that I find "all the wind taken out of my sails," and nothing left for me to do but to express to those Judges my thanks for so materially lightening my pleasant, if somewhat arduous duties.

Report of the Judges on Hackneys and Ponies. (Classes 13–16, 22–24, 46–49.)

It is most gratifying to be able to report that we have had an excellent display of horses at this Show to pass judgment upon, attributable to the increase in the number and value of the prizes, and also, in some measure, to the efforts of the various Societies that have been established to improve and promote the breeding of Riding and Driving Horses. We believe we are correct in saying that there never has been a Royal Show where so many Hackneys and Ponies have been exhibited, the total number of animals in the classes judged by us numbering 120, and these do not include the Classes for Thoroughbred Stallions, Hunters, Hunting Mares and Foals, and Harness Horses.

We have specially to mention the excellence of the younger animals, and particularly those in the Mare and Foal Classes. The foals were, taken altogether, a wonderful lot, and we found many at the foot of plain but useful dams to be full of promise, thus showing that a stamp of quality had been impressed upon them by judiciously mating the mares with *good* sires. There is no doubt that with the extended knowledge of the science of horse-breeding, which will necessarily result from the existence of the various Horse Societies, this excellence will be more than maintained in years to come, and that we shall have no lack of that good stamp of riding and driving horse, the want of which has been so long felt.

The following detailed Report of the different classes has been arrived at by a comparison of the notes made by us during the judging and a subsequent reference to the Show Catalogue.

Class 13. *Hackney Stallions, above* 15 *hands, foaled previously to* 1883.—Sixteen entries. This was a new class, and for that reason did not supply many animals of the sort required, namely, big Hackney Stallions suitable for getting riding horses of size, and match horses. The first-prize winner, "Confident," brown, four years old, by "Confidence" (158), bred by Mr. George Jones, Stow Bardolph, Norfolk, and exhibited by Mr. John Grout, Woodbridge, Suffolk, was of more the stamp required, having substance and good action; but he has not all the quality that one could desire, being a little heavy about his neck and shoulders. The second prize was awarded to Mr. L. J. Shirley's red roan, "Lord Bang" (1030), a six-year-old by "Great Shot," bred by Mr. Isaac J. Bays of Chatteris, Cambs., a good useful animal that has been successful before in the prize-rings. The third prize was won by "Confidence" (158), brown, by "Prickwillow," foaled in 1867, bred by Mr. Rose, Dykebeck, Wymondham, and exhibited by Mr. W. Dunham, Wymondham, Norfolk. Considering that he is nineteen years old, "Confidence" is a wonderful animal, and has been credited with perhaps more

winners than any other Hackney Stallion. The reserve number and highly commended was "Canvasser" (114), black, five years old, by "Confidence" (158), bred by Mr. H. Harrison, and exhibited by Mr. C. E. Cooke of Swaffham; while Mr. G. H. K. Francis's "The Younger Doctor Syntax" (877), a brown, six years old, by "Confidence," was highly commended, and Mr. J. H. Hastings's "Volunteer" (1217), chestnut, four years old, by "Model," was commended. The other stallions in this class were too light and short of bone.

Class 14. *Hackney Stallions, above* 14 *hands, not exceeding* 15 *hands, foaled previously to the year* 1883.—Seven entries. The first prize was taken by "British Prince," black, seven years old, by "Reality" (665), bred and exhibited by Mr. John Sindall, Prickwillow, Cambs. This is a very neat compact horse, full of quality, inheriting the grand action of his sire, and when brought out afterwards with the first-prize Stallions in Classes 13, 14, 15, 16, easily carried off the Champion prize. The second prize was awarded to "Prince Victor" (1327), a chestnut four-year-old, by "Reality," bred and exhibited by Mr. Smith Flanders, Littleport, Cambs.; and the third to "Clockwork" (143), chestnut, six years old, by "Little Model," bred by Mr. D. J. Belding, Fakenham, Norfolk, and exhibited by Mr. John Grout. These last two were both good stallions, but were unfortunate in meeting an exceptional horse like "British Prince." The reserve number and highly commended was "Grey Tom," a grey four-year-old, by "Confidence," bred by Mr. John Youngman, Downham, and exhibited by Mr. Charles Groucock, Wymondham, Norfolk, a nice mover, but too small.

Class 15. *Hackney Stallion, foaled either in* 1883 *or* 1884.—Nineteen entries. This was a very strong class, not only in point of numbers, but especially in point of quality. The first prize was won by "All Fours," a two-year-old chestnut, by "Fashion," bred and exhibited by Mr. John Grout. He is marvellously developed for his age, and bids fair to make a valuable stud-horse. The second prize was awarded to "Physician," a two-year-old red roan, by "Great Shot" (329), exhibited by Mr. John N. Anthony, Sedgeford, Lynn, and bred by Mr. Richard Burgess, Docking, Lynn; a good goer, with plenty of quality. The third prize was taken by "Paragon" (1320), a brown three-year-old, by "Confidence," exhibited by Mr. W. Beart, Stow Bardolph, Norfolk. He is light of bone in comparison with the preceding horses, but is, nevertheless, a good mover. The reserve number and highly commended was "Premier," a chestnut two-year-old, by "Model," bred by Mr. S. Bell, Stifkey, Norfolk, and exhibited by Mr. F. E. Howell, Little Walsingham, Norfolk; whilst "Rob Roy," a chestnut three-year-old, by "Reality," bred and exhibited by Mr. John Rowell, Bury, Huntingdonshire, was highly commended. Neither of these two horses had the same true action as the prize-winners, as "Premier" "dishes" slightly in his walk, and "Rob Roy" has not true fore-action; but in every other respect they were good goers, and their gait may improve with age. Of the remaining animals some of them possessed good points, but showed imperfections of one kind or another, such as want of bone, deficient action, &c.

Class 16. *Pony Stallion, above* 13 *hands, and not exceeding* 14 *hands.*—Six entries. The first prize was awarded to "Barnham Confidence" (895), three years old, brown, by "Confidence," bred and exhibited by Mr. Dalton Vassar, Wymondham, a long, low, well-proportioned pony, with level, true action. The second prize was won by "Pomfret Wonder," black, six years old, by "Little Wonder" (Mr. C. W. Wilson's), bred by Mr. Wright, Doncaster, and exhibited by Messrs. Gottwaltz and Bowring, Cardiff. This was a grand sharp mover, who was only overpowered by the size of his opponent. The third prize was given to "Pick Up" (1087), bay, five years old, by "Model" (1054), bred by Mr. Huggins, Hempton, Fakenham, and

exhibited by Mr. G. M. Nicholson, East Dereham, Norfolk, a very good mover; whilst the reserve number was Mr. Samuel Rose's black and white three-year-old "Lord Magpie."

CLASS 22. *Hackney Mare and Foal, above* 14 *hands* 2 *inches.*—Thirteen entries. This was an exceptionally good class. There were in it, besides those winning prizes, some mares, not good in appearance themselves, yet, having been judiciously mated with good sires, had some capital foals at their side. The first-prize winner was "Princess" (229), chestnut, seven years old, by "Denmark" (177), bred and exhibited by Mr. Henry Moore, Burn Butts, Cranswick, Hull. This well-known mare possesses what is all-important, good shoulders as well as true action, and had a most beautiful colt foal at foot, by "Lord Derby 2nd;" he is a dark chestnut, with one white leg and a white stripe on his face, has fine shoulders, and is altogether a grandly made foal. The second prize was taken by "Constance" (63), chestnut, four years old, bred and exhibited by Mr. E. B. Hamond, Waterden. This mare is a good-looking one, with fine action, and a brown filly foal at her side, by "Confidence," which has good bone, but with shoulders not quite so good as has the "Princess" foal. The third prize was also taken by Mr. E. B. Hamond for his home-bred "Jessie" (152), brown, three years old, by "Confidence" (158), a nice mover, with a brown colt foal by "Lord Derby 2nd" (417), which has good quarters, but is light of bone, and his hocks are not so well set as either of the preceding foals. The reserve number and highly commended mare was the Duke of Hamilton's black "Duchess," a beautiful mare that would have certainly taken higher honours had not her black colt foal, by "Prickwillow," been small and very light of bone. Highly commended also was "Kathleen" (162), chestnut, six years old, by "Star of the East" (798), bred by Mr. Edward Green, Welshpool, and exhibited by Mr. Garrett Taylor, Trowse House, Norwich, a useful mare, with a dark chestnut colt foal by "Norfolk Gentleman" (492), that has plenty of size and good quarters. The following colts were also very promising, and will doubtless be seen again in the prize-ring—Mr. Anthony Hamond's bay colt foal (No. 227), by "Lord Derby 2nd;" Mr. Washington Hamond's red roan filly foal (No. 228), by "Great Shot" (329); Mr. Garrett Taylor's roan filly foal (No. 231), by "Norfolk Gentleman;" Mr. W. Hall's bay colt foal (No. 234), by "Norfolk Gentleman;" and Mr. W. J. Bailey's brown colt foal (No. 238), by "Canvasser" (114).

CLASS 23. *Hackney Mare and Foal, above* 13 *hands* 2 *inches, and not exceeding* 14 *hands* 2 *inches.*—Ten entries. The first prize was awarded to "Alice 2nd" (6), by "Washington" (852), bay, twelve years old, bred by Mr. Edgar Brandford, Wickham Market, and exhibited by Mr. Womack Brandford, Swaffham. This was a beautiful mare, a good goer, with plenty of quality, her brown colt foal by "Canvasser" being a very pretty one, with good head and quarters, its shoulders, however, being a trifle coarse. The second-prize winner was "Nelly Bligh," bay, bred by Mr. Henry Pearse, co. Galway, and exhibited by Lt.-Col. T. Holmes Parker, Warwick Hall, Carlisle; a mare full of quality, with splendid shoulders. Her bay filly foal, by "Sir George" (778), was smart-looking and blood-like, having good shoulders. The third prize was awarded to "Snowdrop" (320), grey, sixteen years old, exhibited by Mr. C. E. Cooke, Litcham, Swaffham; a rare stamp of mare, with filly foal by "Canvasser," which is fairly promising. The reserve number was "Jenny," by "Hurdle 3rd" (382), grey, five years old, bred by Mr. J. Mann, Hempton, Norfolk, and exhibited by Mr. Washington Hamond; a very nice mare and good goer. This mare would have taken a higher position had her filly foal, by "Great Shot," been more promising. There were one or two other good colts in this class.

CLASS 24. *Pony Mare and Foal not exceeding* 13 *hands* 2 *inches.*—Two

entries. The first prize, the only one awarded, was taken by "Wilcot," chestnut, twelve years old, bred by Dr. Parry, Caersws, Montgomeryshire, and exhibited by Mr. A. E. W. Darby, Little Ness, Shrewsbury.

CLASS 46. *Hackney Mare or Gelding (weight carrier) not exceeding* 15 *hands* 2 *inches, and up to not less than* 15 *stone, foaled previously to* 1883.—Nine entries. The first prize was awarded to "Princess," chestnut mare, foaled 1880, by "Lord Derby 2nd," bred by Mr. A. Fewson, Hedon, Hull, and exhibited by Mr. John Robinson, Hull; the second prize being taken by "Ladybird II.," a chestnut mare, foaled in 1880, by "National Guard," bred and exhibited by Mr. J. W. Hume, Hunstanton; whilst the third was taken by Mr. E. B. Hamond, for his home-bred six-year-old bay mare, "Kitty," by "Confidence." The reserve number and highly commended was Mr. John Grout's grey six-year-old "Grey Lock;" a roan gelding belonging to Mr. C. Burrell, Thetford, and foaled in 1878, being also highly commended. The above animals fairly represent the usual style of weight-carriers as exhibited in this class.

CLASS 47. *Hackney Mare or Gelding (light weight), above* 14 *hands, and not exceeding* 15 *hands* 2 *inches, up to not less than* 12 *stone, foaled previously to* 1883.—Twelve entries. The first-prize winner was Mr. Frisby's bay gelding, "Cardiff," eight years old, by "Southampton"; the second prize being taken by "Apology," a seven-year-old brown mare, by "Denmark," exhibited by Mr. John Robinson, Hull. The third prize was awarded to Mr. John Grout's bay gelding, "The Baron," foaled in 1881; the reserve number and highly commended being "King of Fashion," a five-year-old bay gelding, exhibited by Mr. C. W. Blacklock, Hendon, Middlesex. This class was represented by several good animals, the first prize being easily won by "Cardiff," who may be accepted as an exceptionally good specimen of a riding hack. He is full of quality and merit, and carries his saddle and rider well. "Cardiff" eventually took the Champion prize in Classes 46, 47, 48, 49.

CLASS 48. *Hackney Filly foaled in the year* 1883 *or* 1884.—Nine entries. The first prize was awarded to "Sweetbriar," brown, three years old, by "Denmark," bred and exhibited by Mr. Henry Moore, Cranswick, Hull; the second prize to "Mary Anderson," chestnut, three years old, also by "Denmark," bred by Mr. J. M. Clarkson, Pocklington, Yorks., and exhibited by Mr. Mark Pearson, Knaresboro'. The third prize was taken by "Ladylove," a chestnut three-year-old, by "Norfolk Jack" (1071), bred by Mr. R. Balding, King's Lynn, and exhibited by Mr. Alfred Lewis, Heacham, Lynn; whilst the reserve number and highly commended was "Lady Beaconsfield," three years old, chestnut, by "Lord Beaconsfield," bred and exhibited by Mr. G. H. K. Francis, Dereham, Norfolk. "Sweetbriar" is a good all-round mover, showing plenty of quality, and is likely to follow in the successful career of her sister, Mr. Moore's celebrated mare "Princess." She was selected with "Cardiff" for Champion honours, and ran him very close.

CLASS 49. *Pony Mare or Gelding not exceeding* 14 *hands.*—Twelve entries. The first prize was taken by "Contention," a five-year-old bay gelding, exhibited by Mr. W. Case, Aylsham, Norfolk, being a long low pony, with nice free action. The second prize was awarded to Mr. Henry Frisby's "Canary," a noted winner; and the third to "Carthusian," a six-year-old black gelding, by "Sir George," exhibited by Mr. Horace Barry, jun., Guildford; the reserve number was "Merrylegs" (383), a seven-year-old bay mare, bred by Mr. Uriah Wilson, King's Lynn, and exhibited by Mr. Alfred Lewis, Heatham, Lynn, Norfolk.

CHRIST. W. WILSON.
WALTER GILBEY.
ROMER WILLIAMS.

Harness Horses and Cobs.

These classes are somewhat of an innovation at the Royal, owing their introduction to the munificence of the Norwich Local Committee, and of the Suffolk Agricultural Society. An old proverb reads something as follows: "One should never look a gift horse in the mouth;" this may apply equally to the gift of prize-money, so that it might be ungracious to cast the slightest doubt on the advisability of finding a place in the Royal prize-list of classes which have a slight appearance of that "circus" part of the business which is countenanced at the local shows for the main reason that it brings "grist to the mill." If any real benefit to agriculturists can be derived from the exhibition of horses in harness (no one can deny that much pleasure is obtainable, by those who are fond of a good "trapper"), would it not be advisable to adopt the suggestion of the Judges and limit the age of the competing horses? In nearly every class the first- and second-prize winners were old stagers, whose whole life has been spent in perambulating the country as show animals in the Harness Classes. The formation of Champion Classes might be adopted; but by forming these, one of the objects of Agricultural Societies, "to encourage the breeding of farm stock," might be lost sight of.

Report of the Judges on Harness Horses.

The Harness Classes in each case included the best animals in England, and in the opinion of the Judges the action of the first-prize animals was as near perfection as could be desired.

We would recommend breeders, who wish to make money, to produce that action as nearly as they can, remembering that in harness-horses action is money.

The great number of spectators round the ring during the judging showed that great interest was taken in the Harness Horses. The classes were large and good, each having sufficient merit to justify a third prize; and very promising young animals were shown in each class, a feature which speaks well for the future.

In view of the fact that the Royal Show is intended specially to encourage breeding, we think it might be to the advantage of breeders that Harness Horses should not be shown over 5 years old; after that age they ought to be in other people's hands. A Class for Aged Champions might be of great advantage, so that breeders and the public might see the best examples.

James Hornsby.
Clement Stephenson.

CATTLE.

The entries in the various Classes show an increase of more than twenty per cent. over the Preston Meeting, and of nearly fifteen per cent. beyond the number entered for the Shrewsbury Exhibition, and are, in fact, very considerably higher than at

any Show since the International Meeting held at Kilburn. This great improvement is partially caused by the splendid and very extensive displays of Red Polls and of Jerseys; at the same time some other breeds of cattle are better and more numerously represented than at recent Royal Shows, but to this I shall allude in my notes on the different varieties of cattle as they follow in order in the prize-list.

Shorthorns.

It will be observed that the Judges express slight disappointment at the exhibition of Shorthorns as a whole. This opinion appeared to be generally endorsed by those who were taking a keen interest in the proceedings which took place in the judging ring. It could not be said that there were not in most of the classes several individual specimens quite equal to those which have been exhibited in former years; the complaint appears rather to be, that there are a greater number shown which have not those deep ribs, lengthy quarters, and oblique shoulders, all set on short legs and encased in a mellow hide, well padded with muscle or lean flesh. It behoves the breeders of Shorthorns to remember that the public form an opinion as to the good points of the different varieties of stock from those animals which are exhibited at the Royal, not from those specimens, however good they may be, which are kept at home. There is no gainsaying the assertion that the Shorthorn has borne and will bear the palm as the general utility animal in the bovine world; but it must not be forgotten that it has now several competitors for the post of honour, and that those competing breeds are in the hands of stockowners who will leave no stone unturned to place their stock in the most favourable light before the purchasing public. It appears to be both desirable and necessary that the breeders of Shorthorns should make an effort in the same direction.

In the Class for Old Bulls, Mr. Handley's "Hiawatha" and Messrs. Coupland's "Self Esteem 2nd" were not allowed, as usual, to divide the honours; a new aspirant appeared from the Emerald Isle. This was a very handsome and level roan of good style and character, and now owned by Mr. H. Williams, of Moor Park, Harrogate. "Hiawatha" was placed second, and "Self Esteem 2nd" reserved. Mr. Handley was more fortunate in the next class, as his extraordinary good bull "Royal Ingram" took first and, for the second year in succession, the Champion prize of 25*l.*, offered by the Shorthorn Society.

The Two-year-old Bulls were much more evenly matched: some persons looked with the most favour on the deep-ribbed

and short-legged "Dryops," the property of, and bred by, Mr. J. Fielden; the Judges appeared to hesitate, but eventually placed first "Golden Treasure," another of Mr. Handley's exhibits. Mr. Coupland won third with a son of "Self Esteem 2nd," not the only successful produce of the old bull in the yard. The Young Bulls were a very good collection, at the head of which the Judges did not hesitate to place still another youngster bred by Mr. Handley; this was a very lengthy level bull of nice colour. The second-prize yearling, although shown by Mr. A. Metcalfe-Gibson, was also bred by Mr. Handley, and was a son of the Champion prize bull "Royal Ingram." The third prize was awarded to a neat and compact roan shown by Mr. A. L. Duncan. Five others received notice from the Judges.

Only seven entries were made for the three prizes in the Cow Class, but the noted "Snowflake" and an exhibit of Mr. T. Swingler's were absent. The paucity of numbers was atoned for by the excellence of the exhibits. Mr. Teasdale Hutchinson had little difficulty in carrying off not only the first prize in the class by the aid of that grand cow "Lady Pamela," but also the Champion prize for the best Shorthorn female, as well as the second prize in the class with "Glad Tidings." This is indeed something of which any breeder might be proud. The Class for Younger Cows, or those bred in the year 1883, was not well filled. Much better was that for Two-year-old Heifers; here the Judges marked their approval by distinguishing eight of the eleven brought before them. A grand-daughter of the Rev. R. B. Kennard's wonderful cow "Queen Mary," had little difficulty in beating her opponents as she had previously done at other Shows this season; she is long in the barrel, level on the top, and of nice style. The second-prize winner, Messrs. W. Hosken and Son's "Alexandra 9th," could also boast of a Royal winning pedigree, as well as of personal merit sufficient to have enabled her to win numerous prizes, including a first at the Preston Royal. The third-prize winner, "Victoria Formosa" was bred by Mr. T. Hutchinson from a cow bought at Lady Pigot's last sale. There were 23 Yearling Heifers entered, but nine of the stalls were untenanted. This was a somewhat difficult class to judge, especially after the first and second prizes had been awarded to two very promising heifers shown by Mr. D. Pugh and Mr. T. Chalk. The last-named owner's "Ballad" was a daughter of "Self Esteem 2nd." Mr. Wakefield's "Welcome 10th," the Duke of Northumberland's "Bridal Guest," and Mr. Walker's "Ada," seemed very nearly equal in merit; their positions in the prize-list were as they are mentioned.

Report of the Judges of Shorthorns.

The show of Shorthorns, with the exception of one class, cannot, as a whole, be considered up to the usual Royal standard. Although the competition in the *Old Bull* Class (50) was very limited, the prize animals were of considerable merit.

In Class 51, "Royal Ingram" had a very easy victory; the competition in this class was also very limited.

In Class 52 the competition was closer, but ultimately the red ribbon was awarded to "Golden Treasure"; there were two or three good animals in this class.

In Class 53, Mr. Handley again came to the front with his very promising bull "Royal Hovingham," while the second prize was awarded to another very good young bull, also bred by Mr. Handley. There was greater competition in this class, which contained some other useful animals.

The *Cow* Class (54), although few in number, contained some very fine specimens of the breed, and we had little difficulty in coming to a decision.

There was also but little competition in Class 55, and beyond the first-prize animal there was nothing of very great merit; but the competition being so close between Nos. 536 and 539, we recommended that a third prize should be given.

Class 56 was far away the best class among the Shorthorns, containing a larger number of animals of very considerable merit. The competition was very close between two or three of the prize-winners, and it has been but seldom that better animals have been seen in our Showyards.

Class 57, although larger in numbers, with one or two exceptions were not of that merit which one expects to see in a Royal Showyard.

The Champion Prize for the best male was awarded to the well-known bull "Royal Ingram."

The Champion Prize for the best female was awarded to "Lady Pamela," a fine specimen of a Shorthorn cow.

We conclude our Report by acknowledging with our best thanks the able assistance which was rendered to us by the Steward of our department.

Hugh Aylmer.
Charles Howard.
John Wood.

Herefords.

It was as much a source of surprise as of pleasure to find the "white faces" in such grand form, and in such force. The addition of classes to the prize list may have put the West countrymen on their mettle to endeavour to make a suitable response to the liberality and sense of justice exhibited by the Council, or they may have been influenced by the desire to give the cattle graziers of the Eastern Counties a gentle reminder of the extraordinary aptitude of their stock to lay on flesh under generous treatment.

If these were some of the objects of the breeders of Herefords, their efforts were attended with complete success. The display was one which will be remembered and quoted for many a long year.

As justly remarked by the Judges, one or two of the Classes

had but few entries; but these exhibits were so extraordinary and so well known, that the competition was in consequence reduced. Take, for instance, the Aged Bull Class, with such a representative of the breed as the Earl of Coventry's "Good Boy," whose success in the numerous show-rings is only equalled by his personal merit; his scale and substance are immense, and the best beef points are most fully developed.

Then again, for Cows calved in 1883, we find only 2 entries, but these are most worthy grand-daughters of perhaps the two most noted Hereford sires, "Horace" and "Lord Wilton." Both cows have won champion and other prizes enough to stifle competition.

In the Class for Bulls calved in the year 1883 is found another of those wonderful animals, whose production by the Hereford breeders is becoming almost common; this is "Maidstone," the property of and bred by Mr. H. W. Taylor. "Maidstone" is a grand bull, but is beginning to require a little rest from the excitement of so frequently taking the leading honours in our Showyards.

In the Class for Yearling Bulls there are changes of position in the prize list from those of previous Shows. This is scarcely to be wondered at in the judging of immature and growing young bulls; the effect of travelling and the excitement attending their exhibition affect in a different way young animals of all varieties of stock. Some youngsters will rest, thrive, and improve; whilst others will fume and fret, and lose all the gilt which the stockman has taken such pains to apply.

A sharp contest was expected in the Aged Cow Class between the two celebrated animals "Golden Treasure," bred and exhibited by the Earl of Coventry, and "Sunflower," whose breeder and exhibitor was Mr. A. E. Hughes. Although "Golden Treasure" is beginning to show signs of age and of the effects of long-continued training, yet she was able to score her third win in the Royal Showyard. Some persons favoured "Sunflower's" chances, but grand a cow as she is, there is just a trifle of gaudiness about the rump end. As in the Bull Calves, so in the Two-year-old Heifers, the positions of the prize-winners have varied; the placing first of Mr. W. H. Taylor's very heavy fleshed and evenly formed heifer appeared to meet with general approval; the same owner's "Gem" was beaten by Mr. J. R. Hill's "Lorraine" for second place.

The Yearling Heifers have changed positions sufficiently often during the season to satisfy even those exhibitors who assert that they like to exhibit young animals, as there is just a trifle of chance, or as near an approach to mild gambling as to make it extra exciting.

The Council of the Hereford Herd Book Society offered prizes of the value of 20*l.* and 10*l.* for the best Yearling Bull and pair of Yearling Heifers. This caused a most interesting competition; but it might perhaps be rendered still more so, if it were stipulated that the three animals should be by the same sire. The change would bring out the impressiveness of the sire, which is a quality most marked in Hereford bulls.

Report of the Judges of Herefords.

Class 58.—No. 578 is an extraordinary good animal; No. 577 but little inferior, and well deserving of a second prize.

Class 59.—No. 584 stands out a good first; No. 587 is second, a big fleshy animal, closely run by No. 586.

Class 60.—In a numerous class, No. 594 is a very promising bull, well deserving first honours.

Class 61.—The *Yearling Bulls* were in strong force. No. 602 stood first, closely followed by No. 600 and 599, both good animals; the Reserve, No. 609, is of very good quality but lacks size.

Class 62.—A cow of beautiful quality, No. 624, was first; No. 621, a grand cow with great substance, being second; No. 618, another very fine cow, but rather deficient in the thigh, being third.

Class 63.—Though but two *Heifers* were shown in this class, we recommended the second prize being awarded, as both animals are of such great merit that we could not expect them to be excelled.

Class 64.—We could not do less than commend the whole of this class, the three prize-takers being of unusual excellence.

Class 65.—Does not call for any special comment.

Class 66.—A large entry of superior animals well representing the breed.

Considering the great distance at which the Show was held from the home of the white faces, we considered them well represented. In some of the classes the entries were few, but the specimens are of great merit.

Thos. Fenn.
John White.
John Williams.

Devons.

No one looked for a very large entry of these old favourites, yet one could not feel quite satisfied with only 28 entries in five classes. Nor did the decisions of the Judges appear to give complete satisfaction. Complaints were made that, in awarding the prizes, no particular type or style of animal was adhered to; this was noticeable in the Class for Old Bulls, where the first prize was awarded to a neat, compact, fine-quality bull, shown by Mr. J. Walter; and the second to Mr. Skinner's "Lord Cutsay 2nd," a bull of quite a different character, whilst they reserved the same owner's "General Gordon," which seemed to be, and if previous preferences may be considered, was, the best Bull in the Class. The Yearling Bulls, "Ferryman," the property of Sir W. Williams, and "Duke of Pound 10th," belonging to Mr. A. C. Skinner, appeared to be very equally

matched. The reserved bull, "Tempter 2nd," shown by Mr. J. Walter, is very promising. The first and second-prize cows have often competed against each other with varying success; but, at the present time, Mr. A. C. Skinner's "Moss Rose 8th" is certainly the superior of Mr. John Howse's "Daisy 4th," which was suckling a beautiful little calf. Considerable surprise was expressed at the decisions of the Judges in the Class for Heifer Calves, most of those looking on considering that at least three better heifers were exhibited than those to which the prizes were awarded.

Report of the Judges of Devons.

The Devon cattle were small in number, and, taken as a whole, we consider that the various classes were not equal in merit to those exhibited in previous years. There were, nevertheless, some good animals in the *Bull* Classes and also in the *Cow* Class; but in the *Young Heifer* Class there were some very nice and promising animals which may probably be heard of at some future day.

H. W. Keary.
Alfred Agate.
Henry Quartly.

Sussex.

It appears to be generally admitted that the improvement made during the last ten or fifteen years in this most useful variety of cattle has been very considerable. The quality has been much improved, and the fattening properties increased, whilst the general-utility points have not been neglected. The result is one of which the breeders of Sussex cattle may justly be proud, as was also the display at Norwich. In the Aged Bull Class, Mr. J. S. Hodgson had no difficulty in securing the first prize by the aid of "Prince Rufus," a bull of fine quality, great arms, thighs, and substance generally. He occupied a similar position at the Preston Royal. The second-prize bull, the property of Mr. J. Goodman, appeared a trifle low in the back. With this exception, but little fault could be found with him. Mr. W. S. Forster's "Mikado," a very level straight-topped bull, with rather a hard touch, was reserved and highly commended. The first-prize young bull, shown and bred by the Earl of Winterton, fully deserved his position, being a most promising youngster. As the Judges remark, the others in this class were scarcely so good as were the cows and the two-year-old and yearling heifers. In these classes Mr. W. B. Waterlow was very successful, taking not only first and second prizes in the Cow Class, but also the first prize in the Class for Two-year-old Heifers. The first-prize cow, "Old Mayflower 4th," was a splendid specimen of the breed, as level as a die, and possessing the quality of a Devon. "Confidence," the cow

placed second, had more size, but not quite the quality or neatness of the other. The first-prize heifer, "Daisy 6th," was, like "Old Mayflower 4th," bred by Mr. A. Agate, and reflects much credit on his herd. Twelve Yearling Heifers were entered, and so good were they that the Judges had no hesitation in highly commending the whole of them, an honour which they richly deserved.

Report of the Judges of Sussex Cattle.

The Sussex Cattle were certainly well represented, and in the *Old Bull* Class there were several good animals. We cannot say the same for the *Young Bull* Class, with the exception of the first-prize animal.

We considered the *Cow* Class a meritorious one, and also the *Heifer* Class; but the *Young Heifers* we considered to be of superior merit, and reflecting great credit on their breeders.

In conclusion, we think it right to observe that we think a very great improvement has taken place in the Sussex cattle generally during the last few years.

H. W. Keary.
Alfred Agate.
Henry Quartly.

Welsh.

In no breed of cattle is there a greater improvement noticeable than amongst the Welsh. The formation of a Herd-book, and the increased attention paid to this most useful and picturesque variety of the bovine race, appear to have brought to public notice many good qualities of which they were not generally considered the possessors. The number of entries in each class was not large, but the general quality of the exhibits was of a high order. In the Aged Bull Class the first prize was awarded to Earl Cawdor's "Zulu," a long and low bull, with plenty of muscle. His Lordship also won first prize in the Class for Young Bulls, and second for Cows. A bull of great length and substance won second prize for Colonel Platt, who was also successful in taking first prize in the Cow, and also in the Two-year-old Heifer Classes with meritorious animals. Mr. Oakley took the first, and Mrs. Williams the second, prize in the Class for Yearling Heifers, in which, as in the Cow and the Two-year-old Heifer Classes, the Judges noticed all the exhibits, thus testifying to their high quality.

Report of the Judges of Welsh Cattle.

Classes 77 to 81.—We are much gratified to see so good an exhibition of Blacks from the Principality, the Classes being well filled, and the animals, excepting in the Class for *Yearling Bulls*, being of great merit.

Thos. Fenn.
John White.
John Williams.

Red Polled.

It was confidently expected that the breeders of the Norfolk and Suffolk Red Polled cattle would make a special effort to place their favourites before the public in as favourable a light as possible; but the most sanguine of East Anglians could not for one moment have imagined that so grand a collection of Red Polls could have been possible. The improvement made during the past few years in the style, substance, and quality of the animals, as well as the advance towards uniformity of type, is within measurable distance of the marvellous. No stronger proof of this can be desired or given than is to be found in the fact that the Judges (all three of whom are keen men of business and thoroughly practical) commended in its entirety the Class of Cows with its thirty entries. Such an event as this is almost unknown and but very seldom deserved.

Twelve Aged Bulls were entered; the first in his class and the Champion bull of the breed was "Falstaff," a grand animal of ten summers, who still moved with the greatest possible freedom, and whose masculine character and great substance with fine quality marked him out as one of the best bulls of the breed which had ever been exhibited. It was no disgrace to Mr. J. J. Colman's "Don Carlos" to play second fiddle to "Falstaff;" the fight might have been a trifle closer had "Don Carlos" not shown signs of being over-done, and a slight want of masculine character. Mr. A. Taylor's "Passion," first at the Preston Royal, had to be content with the reserved and highly commended tickets. This bull has not improved during the last year.

Although there were only three exhibits in the Class for Bulls calved in the year 1883, yet so highly did the Judges esteem the merits of the trio, that they asked that a third prize should be awarded, a request which was complied with. The first-prize bull, which also held the distinguished honour of being reserved for the Champion prize, is a son of one of the most celebrated Norfolk Polled sires, "Davyson 12th," and was bred by his exhibitor, Mr. W. A. Tyssen-Amherst. The second prize went to a deep-fleshed bull bred and shown by Mr. T. Brown.

The Bulls calved in the year 1884 were not particularly noticeable for excellence, whilst from the twenty-one Yearling Bulls it would have been possible to select some very promising animals, and mayhap a few not likely to be retained as sires. Mr. J. J. Colman's "Iago," placed first in the class, was a very neat and stylish calf, perhaps slightly deficient in masculine

character; the same remarks would apply to the third-prize winner "Blandford," owned by the Duke of Hamilton. Lord Hastings's "Erebus" appeared fully entitled to his position of second. The Judges highly commended two and commended three other young bulls.

The Judges of the Red Polls at Preston suggested the removal of the age limit of 3 years and 7 months in the Cow Classes; this suggestion was acted upon, and with the most gratifying result that thirty of the best cows ever seen in one class were entered for the three prizes. In adjudicating on the merits of Mr. J. J. Colman's "Dolly" and Mr. J. Hammond's "Davy 28th," the Judges appeared to have great difficulty in coming to a decision. They eventually placed "Dolly" first and Champion female, and "Davy 28th" second. So even in merit did these two splendid cows appear, that no great injustice would have been done had the positions been reversed. The same exhibitors had also two other very fine cows, over which the third prize and the reserve cards were placed.

In the Class for Heifers calved in 1883, Mr. J. Hammond exhibited two very promising heifers, one of which would have taken the first prize had she not been suffering from a severe injury; the other was placed second to Mr. A. Taylor's "Bugle," a massive heifer, dark in colour and rather strong in hair.

Amongst the two-year-olds were some grand heifers; undoubtedly the best was Mr. J. J. Colman's "Midsummer Rose," the possessor of a wide loin, well sprung ribs, and lengthy quarters. This heifer was reserved for the Champion prize for cows or heifers. Mr. W. A. Tyssen-Amherst's "Emblem" fully deserved the blue rosette.

Mr. J. Hammond and Mr. J. J. Colman were again successful in the Yearling Heifer Class, the first-named taking the first and third prizes and the reserve number, and the latter the second prize, with very promising youngsters. It has been said that one should not "prophesy unless one knows," but I cannot help expressing an opinion that it will be many years before such another fine collection of Red Polls is seen.

Report of the Judges of Red Polled Cattle.

The Royal being held in Norfolk, which may be said to be the home of the Red Polled Cattle, this breed was very well represented both in numbers and quality, and was certainly one of the leading features of the Show. The Red Polled Cattle have wonderfully improved during the past few years, especially as beef-producing cattle.

The *Aged Bull* Class was of great merit, and we might have given more commended tickets. No. 749, a bull calved in 1876, is a splendid specimen

of the breed, being muscular, thick, and level. He walks well and carries his age well. No. 753, although well brought out, did not stand nor walk so well.

In the *Three-year-old Bull* Class only three *Bulls* came before us, but they were so good that we specially recommended the Society to give three prizes.

Class 84.—*Bulls calved in* 1884—was a large and good one.

In the *Yearling Bull* Class, 85, we had a number of really good animals. Nos. 794, 791 and 787, are of great promise. Several were shown in this class which ought not to be retained as sires.

Class 86.—*Cows calved previously to* 1883—was beyond question an extraordinary one. Having selected 12 cows, we placed them together in a line, and we venture to say few people have seen 12 better cows of any breed shown together. No. 821, a seven-year-old cow, we placed before 804, as she had great depth and substance, and here perhaps we looked more to the beef than to the milking qualifications. This class was so good that we commended the whole of the exhibits.

Class 87—*Heifers calved in* 1884—was well filled, and the animals were of exceptional merit. It was rather difficult to arrive at a decision, as part of them were in-milk. No. 833 is very good.

Class 88, although not large, was a splendid one, No. 857 being unusually good.

Class 89 was a large and good one. No. 875 was very good, and, in awarding second prize, it was difficult to decide between Nos. 872 and 883.

The Champion prizes we unanimously agreed to award to the aged bull, No. 749, and the cow, No. 821.

Robert S. Bruce.
Robert C. Cooke.
George Napper.

Jerseys.

This useful and ornamental variety of stock was more numerously represented at Norwich than any other breed of cattle. The Jersey boom—to use an Americanism—appears to continue longer, if in a less acute form, than it lasted in the States, where the prices paid for specimens of the breed ran into several thousand dollars; but the natural result followed, as the fever was too severe to last for any length of time. In our country the Jerseys have gradually grown into popularity, so that we may hope that their favouritism will be more lasting. There was, as usual, some slight demur at one or two of the decisions of the Judges; there may or may not have been any cause, but this I can safely aver, "I never saw a trio of Judges take such evident pains to thoroughly examine every point of each animal." In the Aged Bull Class, no fewer than thirty-four bulls were entered, but some of them did not put in an appearance. A very handsome bull, the property of Mr. T. H. Hyde, was placed first, a position with which "Royal Blue" was not unfamiliar, as he had previously won first honours at the Bath and West of England and at the Essex Shows. The Hon. C. R. C. W. Bamfylde's "St. Mary's King" was placed second, in

front of Mr. T. H. Hyde's "Dog Fox," a bull which greatly distinguished himself at Portsmouth, where he not only won the first but also the Champion prize. This, however, was in the absence of "Royal Blue." Four other bulls were highly commended, and the same number commended. The entries in the Class for Young Bulls numbered thirty-one. The general merit was not perhaps quite equal to that of the bulls in the previous class. A difference of opinion appeared to exist amongst the onlookers as to the merits of the first-prize winner, Mr. W. Arkwright's "Scarsdale Astronomer Royal" (what a name!) and Mr. H. J. Cornish's "Brilliant." The latter won first prizes both at Portsmouth and at the Bath and West of England. It is a noticeable circumstance that all the prize-winners in the Classes for Bulls were imported.

The show of Cows was a grand one. It was indeed a treat to see them paraded in the large ring, so handsome and so gentle. By the way, how is it that the Jersey females are so docile, whilst the males (even the bull calves) are so fiery and fierce? Mr. H. J. Cornish's "Bragga" and Mr. J. Blyth's "Rosy" appeared to be very evenly matched; the style of the latter had to give way to the greater milking capabilities of the former. Nearly half of the fourteen entries in Class 93 were absent. The Two-year-old Heifers were numerous, but it will be observed that the Judges deemed it their duty to call attention to a serious deficiency in the development of the fore-quarters of the udders of several of the heifers. This is a very important point in animals which are most highly prized for their dairying properties and for their beauty; nothing detracts more from the appearance of a milch-cow than a faulty udder. Of the thirty-nine Yearlings entered, all but two were sent, and amongst them were many very pretty little animals; but here again the Judges noticed several with ill-shaped udders. This caused some otherwise promising heifers to lose the position in the prize-list to which they might otherwise have been entitled. Besides awarding the three prizes the Judges distributed twelve high commendations and commendations, so that, with all their faults, the yearling heifers deserving of recognition were somewhat numerous.

Guernseys.

Increased attention has been called to this most valuable milking variety of cattle by the formation of a herd-book for the registration of pedigrees. A marked improvement is already noticeable in the quality and style, as well as a great increase in

the number, of Guernseys exhibited and kept in this country. The entries at Norwich would have been more numerous, had there been a Class for Aged Cows, as in some other sections. Now that the breeders show an earnestness in their work, and a desire to exhibit their stock, the Council of the Society will, perhaps, see fit to place this additional class in the next or in a future prize-list. It appeared to be almost a foregone conclusion that the first prize would be awarded to the splendid bull "Climax," the property of the Express Dairy Co., whose energetic manager has taken much pains to cultivate and to bring before the public the many good points of the Guernseys. The Hon. Mrs. Baillie Hamilton supplied a very good second in the fine quality bull, "Loyal," whose son took the first prize in the Yearling Bull Class. A very promising youngster took the second prize for Mr. G. N. Wyatt. In the Classes for Cows and for Heifers some very choice specimens were exhibited by the Express Dairy Co., Major Herbert L. Green, Mr. G. N. Wyatt, and Mr. W. A. Glynn, who secured all the prizes and commendations.

Report of the Judges of Channel Islands Cattle.

The Judges consider that both breeds of Channel Islands Cattle furnished some good representatives to the 1886 Show.

The number of classes of Jerseys was 6—comprising 184 animals; that of Guernseys was 5, and included 39 animals.

Class 90.—Nos. 903, 917, 902, all bulls of excellent appearance.

Class 91.—First prize, No. 947. An animal of good promise with a well-defined and rich escutcheon.

Class 92.—This was a class of considerable merit, and included some good specimens of dairy cows. In the prize-list, No. 970 is a deep symmetrical cow, not very large, but of fine quality; No. 975, though less rich than the first-prize cow, is a nice animal with a good skin; No. 956 is a good dairy cow.

Class 93 was the weakest among the Jersey classes—and, with the exception of two or three animals, was only of moderate pretensions. The first prize-taker, No. 989, is, however, a very shapely cow and a good milker.

Class 94.—In connection with this large class the Judges wish to point out the need of greater attention to the *udder*. Amongst the heifers exhibited there were a large proportion with faulty udders, owing to a want of development of the fore-quarters. Great importance should be attached by breeders to this point, not only because any failure there is unsightly, but also because it tends to impair the practical usefulness of the cow.

Class 95.—This again was a large class, and at first sight it presented an imposing appearance in the show-ring; but on closer examination the same defect that we have noticed in the preceding class made itself apparent: and in consequence, many animals—in other respects attractive—had to be rejected. As a step towards improvement in this particular, the Judges urge upon breeders the necessity of selecting such bulls only as are the descendants of known and approved dams. Apart from this knowledge there can be no certain grounds in breeding for this valuable dairy point.

Guernsey.—In reviewing the classes the decisions of the Judges were based upon those general lines of dairy merit which are common to both breeds of

cattle, and they take this opportunity of expressing their estimate of the value in the butter dairy of many of the animals which passed under their notice.

THOMAS FALLA, Jun.
JOHN FREDERICK HALL.
HERBERT A. RIGG.

OTHER BREEDS.

The Classes for "Other Breeds" were principally noticeable for the picturesque and curious Hungarian cattle sent from the Home Farm of H.R.H. the Prince of Wales, and for the marked superiority of the Polled Angus cattle sent by Mr. C. Stephenson, who, with six entries, won two firsts, two seconds, and reserved; by Mr. Greenfield, who won two firsts; and by Mr. Loder, who won one first prize.

DAIRY CATTLE.

The Classes for "Dairy Cattle" appear to prove one of two things, either that the conditions are too stringent, or that the cows exhibited were deficient in milking qualities. The entries numbered twelve and five, but only one cow in each class qualified by giving the required quantity of milk containing not less than 12 per cent. of solids.

Report of the Judges of "Other Breeds" and of Dairy Cattle.

CLASS 101.—The first prize, an *Angus*, of considerable merit. Second, an *Ayrshire*, moderate; nothing else of much merit.

CLASS 102.—A fairly good specimen of the *Polled Angus*.

CLASS 103.—First, a *Polled Angus*, exceptionally good. Second, a *Dexter Kerry*, of good character and excellent dairy properties.

CLASS 104.—Two first-rate *Angus* headed the class; these were followed by an *Ayrshire* and several *Kerries*, which were entirely out-classed.

CLASS 105 contained only three *Polled Angus*, all of considerable merit.

The Judges are of opinion that classes of mixed breeds, such as the above, are unsatisfactory to competitors, of little use to the public, and embarrassing to the Judges.

CLASS 106.—No. 1158. A fine large *Cow*, good as a milker and grazier—nothing else worthy of special mention.

CLASS 107.—Only one exhibit and that very moderate, beyond being a fair milker. The Judges in this case recommended a second prize.

The Dairy classes, as a whole, were disappointing.

R. STRATTON.
WM. GRAHAM.
LUKE CHRISTY.

Report of the Consulting Chemist on the Milk from Cows in Classes 106 *and* 107.

In CLASS 106, five cows competed; and in CLASS 107, one only. These were milked in the presence of the Judges on the morning and evening of

July 12th, the weights and measures of milk being recorded at the time. Samples were also taken for analysis, and sent to the Society's Laboratory.

TABLE of RESULTS of MILKING TRIALS of DAIRY COWS at NORWICH, 1886.

No.	Morning Quantity.			Weight.		Evening Quantity.			Weight.		Total Quantity.			Total Weight.		Percentage of Total Solids.
Class 106.	qts.	pts.	gills.	lbs.	oz.	qts.	pts.	gills.	lbs.	oz.	qts.	pts.	gills.	lbs.	oz.	
1158	11	0	0	26	12	7	1	0	18	2	18	1	0	44	14	12·11
1160	9	0	0½	22	0	5	0	1	12	0	14	0	1½	34	0	11·98
1161	9	0	0	21	12	4	1	0	10	14	13	1	0	32	10	11·95
1162	8	1	0	20	12	4	1	0	11	0	13	0	0	31	12	13·43
1163	12	1	1	30	6	7	0	0	16	4	19	1	1	46	10	11·70
Class 107.																
1170	9	0	2½	23	4	5	1	2	13	2	14	2	0½	36	6	12·33

ANALYSES.

	No. **1158.**	No. **1160.**	No. **1161.**	No. **1162.**	No. **1163.**	No. **1170.**
Water	87·89	88·02	88·05	86·57	88·30	87·67
Fat	3·38	2·95	2·77	3·67	2·79	3·53
Casein, Milk, Sugar, &c.	7·99	8·25	8·52	9·09	8·22	8·08
Ash	·74	·78	·66	·67	·69	·72
	100·00	100·00	100·00	100·00	100·00	100·00
Percentage of Total Solids	12·11	11·98	11·95	13·43	11·70	12·33
Spec. Gravity	1·0310	1·0305	1·0325	1·0310	1·0305	1·0315
Percentage of Cream, by volume	8·0	7·9	6·5	11·0	7·0	8·6

From the above Tables it will be seen that Nos. 1158 and 1170 were the only ones that fulfilled the conditions of the competition, 1160, 1161 and 1162 being deficient in the quantity of milk yielded, and 1163 being deficient in the quality of the milk.

J. AUGUSTUS VOELCKER.

SHEEP.

In this division of the Royal Showyard the old show-goer will have marked a great change during the last twenty years; the long-woolled light-faced breeds have had to give way to a very great extent, not only to varieties of sheep then exhibited and having dark faces, but to several new breeds with coloured points; some of these new varieties furnishing a larger number

of entries than the whole of the white-faced breeds. The principal causes are not far to seek; amongst them may be enumerated, the change in the system of husbandry, the heavy imports of wool from all parts of the world, and the demand for smaller joints of mutton with a less proportion of fat. Another noticeable feature would be the introduction of classes for lambs of several of the breeds of sheep. A keen observer would also notice that the Hampshire lambs were the only ones in which nature was allowed to take the place of art, as they were alone in a "state of untrimmedness." Other lambs had their docks more or less trimmed or *squared*, as the shepherds call it, and one must confess that their appearance was much improved thereby. Would it not be better to allow the lambs to be treated in the same way as the older sheep, that is, if it be admitted that the trimming and colouring of sheep are to be allowed?

Leicesters.

Changes in the fashion of the woollen clothes we wear, the general low price of wool, and the almost complete alteration in the taste or demand for the mutton we eat, have heavily handicapped the Long-wools. In the Leicester classes, one found evidences of the changes wrought: the exhibitors numbered but four, and the entries but eighteen, to compete for eight prizes. Mr. T. H. Hutchinson sent two old rams, won both prizes; three Shearling rams, took both prizes and the reserve number; and one pen of ram lambs, and ran away with the first prize, the second going to Mr. T. Strickland.

Only two pens of Ewes were shown, both belonging to Mr. E. F. Jordan; thus all the prizes went to Yorkshire.

Cotswolds

were more numerous than the Leicesters, numbering 28 entries, of which, however, 12 were contributed by Mr. T. Brown, 9 by Mr. R. Swanwick, and 7 by Messrs. T. and S. G. Gillett, so that here the competition was even more limited than in the former division. The Classes for Single Rams were filled by superior specimens of the breed; the quality and substance of the only pen of Ewes were good.

Lincolns.

In this department we missed the grand sheep shown in former years by Mr. H. Smith, who has decided to take his well-earned retirement from the Showyard as an exhibitor of Lincolns.

His place was ably filled by Mr. J. Pears, Mr. R. Wright, Mr. H. Dudding and Mr. T. Casswell, who contributed 5, 7, 7, and 2 entries respectively, to the total of 21, in competition for the eight prizes offered. The Shearling Ewes especially called for notice on account of their great excellence.

Other Long-Woolled Breeds.

In this division the "Devon Long-wools" took all the prizes but one, a second only being awarded to Mr. J. Hough's pen of Wensleydale Ram Lambs. Sir J. Heathcoat-Amory took five, and Mr. C. Norris two, prizes with very fine specimens of the Devon Long-wool.

Report of the Judges on Leicesters, Cotswolds, Lincolns, and other Long-woolled Sheep.

Leicesters.

The Judges cannot congratulate the Council on the number of entries, but the prize-winners are quite equal to those of former years.

Cotswolds.

Classes 112 and 113 contained not only larger entries than usual, but we considered them above the average in quality.

The three entries of *Ram Lambs* and the entry of *Shearling Ewes* call for no special comment.

Lincolns.

The *Two-shear Lincoln Ram* Class contained only two entries; No. 1224, first prize, is a heavy sheep, but has not quite a nice skin. *Shearlings*, a large entry of about the average merit. The winning *Shearling Ewes* are grand specimens of the Lincoln breed.

Other Long-woolled Sheep.

Classes 120 to 123 inclusive (not qualified to compete in any of the preceding classes) contain some good specimens of the Devon *Long-wool.*

W. T. Garne.
Henry Smith.
George Walmsley.

Oxfordshire Downs.

The prizes offered for these sheep, which are becoming as great favourites abroad as at home, not only for breeding pure breds, but also for crossing purposes with the Merinos and other white-faced breeds, have not generally been competed for by many exhibitors.

At Norwich a great improvement was visible, and the list of exhibitors received the addition of some new names. It was also noticeable for the return into the Showyard of the names of two veteran breeders and successful exhibitors; these were

Mr. Charles Howard and Mr. Henry Overman, whose flocks took such a prominent position in the prize-lists of other days, thus gaining a reputation for high class sheep which has enabled them to dispose of their rams and surplus stock without the expense and worry of a frequent and continued getting up of their animals for exhibition.

In the Aged Ram Class the first prize was won by Mr. J. Treadwell's ram, which was so successful last season. Some surprise was expressed at the action of the Judges in awarding the second prize to a ram from the same flock, as there was a decided grey tinge in the wool upon the ram's side. A very thick-fleshed and muscular sheep of good quality and style, shown by Mr. F. Street, it was thought, should have taken the second position; indeed so good was this last-named ram, that the Judges asked for a third prize to be awarded to it.

There was a well-filled Class of Shearlings, amongst them several very good rams, without there being any single sheep of superlative excellence. The Judges did not appear to give complete satisfaction; they passed over, without even a commendation, a grand ram of Mr. C. Howard's which ought certainly to have been placed. This ram was afterwards shown at the Bedfordshire Show, where it won first prize in the Shearling Class, beating the Norwich first-prize Hampshire Shearling; and at Mr. C. Howard's sale realised the goodly sum of seventy-one guineas.

Mr. W. H. Fox took first prize in the next Class, with three very matchy and heavy ram lambs.

The Shearling Ewes were good, five of the seven pens entered being noticed by the Judges, who, in this class at all events, could not be accused of being sparing of commendations.

Report of the Judges of Oxfordshire Downs.

Class 124.—Twelve entries. We found good sheep to which to award the prizes, and the reserve was highly-commended and worthy of a third prize.

Class 125.—Twenty-nine in number. On the whole, we considered this class good, but containing nothing of very special merit; we found them of uniform character.

Class 126.—Nine entries. This class we hoped to see more fully represented.

Class 127.—Seven entries. After awarding the prizes, we felt justified in commending two pens.

Charles Hobbs.
J. A. Miles.

Shropshires.

No one for a moment expected to find at Norwich, so far from their home, such an extraordinary display of Shropshires as

was witnessed at the Shrewsbury Meeting, held in the midst of the district in which they are more particularly reared; yet it was thought that the enterprising breeders of this dark-faced Down would not fail to make an effort to bring some of their best sheep for the public to admire. These expectations were realised, the Class for Shearling Rams having no fewer than 61 entries, of which more than half received honourable notice at the hands of the Judges. In such a large and good Class it was a great feat for Mrs. Barrs to win both first and second prizes with splendid sheep bred by herself. Mr. J. Beach sent a very good ram to take third position.

In the Aged Ram Class the first and second prize winners, belonging respectively to Messrs. H. and A. Bradburne and to Mr. J. Pulley, retain the positions held by them at Bristol. The Ram Lambs were not numerically strong. A far better Class in every way was that for Shearling Ewes. It appeared to be a very near thing between the first-prize pen shown by Mr. P. A. Muntz and that by Mr. Minton; the style, character, and substance of those placed second were very good. Of the 12 pens entered, 8 received notice, and fully deserved it.

Report of the Judges of Shropshire Sheep.

Although a long distance from home, the *Shropshire Sheep* Classes were well filled at Norwich.

Beginning with the *Two-Shear Rams*, Class 128, there were 15 entries, most of which were good sheep, particularly the prize and highly-commended animals.

Class 129.—This was a large class, the number being 61. The first and second prize-takers were large roomy sheep of great size, with good quality of wool and mutton; a large number of the others showed careful breeding and good Shropshire character.

Class 130.—*Ram Lambs.*—In this class there were only 6 entries, 4 of which were very good and looked like growing into good sheep.

Class 131.—*Shearling Ewes.*—There were 12 pens entered in this class, the whole of which were very useful animals; so even were they, that, after reducing them to 6 pens, we had some difficulty in selecting the prize-winners.

John Edward Farmer.
Richard Barber.

Southdowns.

It will doubtless be considered very presumptuous on the part of an "official reporter" to express an opinion which is not quite in accordance with the Report of the Judges; but "duty first, then pleasure," ought to be the universal motto. From the Report of the Judges one would infer that the South-downs at Norwich were not good, or even up to the average. After a hasty examination of the various Classes, I came to a

conclusion somewhat different from that of the Judges, not only as to the general quality of the Southdowns, but also as to the individual merit of several of the pens of sheep. I did not trust to my own ideas, but asked the opinions of uninterested persons who were well qualified to be consulted. Exception was taken to the first-prize sheep; he had style, character, handled well, and his wool was good, but he was so bare underneath and his wool showed such signs of peeling, that great objection would be raised to his use in many of our best flocks. Mr. J. J. Colman took the second and the Duke of Richmond third prizes with really good Southdowns, if not quite so finely bred.

It *might* be correctly stated that with a Class of 67 Shearling Rams, selected from most of our best flocks, that the Southdowns "had been better shown than at Norwich," still such an assertion is open to question. Mr. Hugh Gorringe was fortunate in taking the first prize with No. 1476, as this ram did not appear to some as equal to his second-prize winner; it was mean in its hind quarters, nor did it stand well on its hocks; some persons would have preferred to either, the third-prize ram shown by Mr. J. J. Colman, which handled well, was good in the scrag, and looked like a *ram*. The Judges highly commended two and commended two others; but there appeared to be many other rams in the Class fully deserving of honourable mention, amongst these were the Prince of Wales's, Messrs. Botting's, and other rams shown by Mr. Colman.

The Ram Lambs did not appear to possess any especial merit. The Shearling Ewes were very good; Sir William Throckmorton's fairly took pride of place; a good second was Mr. G. Jonas's pen, in which were two of the finest ewes it has ever been my good fortune to see. As in the previous Class, other pens beside those noticed were thought to deserve recognition.

Report of the Judges of Southdown Sheep.

We have seen the Southdowns better shown than at Norwich. In the *Old Ram* Class the first-prize sheep, belonging to Mr. Hugh Gorringe, is a perfect specimen of a Southdown, both in character and wool, though not quite so well covered as we should like to see him; Mr. Colman, M.P., took second with a big heavy fleshed sheep, His Grace the Duke of Richmond and Gordon being third with a sheep of beautiful quality, somewhat deficient in substance for a *Two-shear*.

The *Shearlings* were a difficult class, some of the best having to be passed over on account of bad wool. Here, again, Mr. Gorringe was first and second for sheep of splendid quality, Mr. Colman, M.P., being third with a big heavy sheep.

The *Shearling Ewes* were a grand class, Sir W. Throckmorton being first

with a beautiful, even, well-matched pen, complete in character; Mr. G. Jonas taking second, the Duke of Hamilton third.

In the *Lamb* Class, Mr. Colman, M.P., was first, both for rams and ewes. We are of opinion that the Southdowns, though increasing in size, are deteriorating in quality.

Class 132.—Not so good as we have seen them.

Class 133.—A large entry; with the exception of those named, deficient in character and wool.

Class 134.—Big useful lambs, but wanting in quality.

Class 135.—A splendid lot, and quality well preserved.

Class 136.—Big useful lambs.

Hugh Penfold.
Arthur Wm. Crisp.

Hampshire Downs.

The long distance of this year's Royal from the home of the "coming sheep" may be pleaded in excuse for the somewhat small entry of a variety of sheep, for which some of its admirers make the claim that it is possessed of most of the good qualities of all the ovine breeds, if not that it is the original or foundation-stock from which many other varieties have obtained a large share of their good points. There is not the slightest doubt that, for early maturity, the Hampshire stands pre-eminent, and that this quality is transmitted to cross-breeds, in which either the sire or dam is a Hampshire.

In the Two-Shear Ram Class Mr. Henry Lambert was invincible, taking both prizes with two very fine sheep. A very lengthy shearling ram, shown by Mr. T. Buxton, is placed first, but some persons preferred the second-prize sheep, belonging to Mr. F. R. Moore. This ram has previously won first prizes at the Royal Counties and at the Wiltshire Shows, and was also a champion winner last season when shown as a ram-lamb.

Mr. F. R. Moore also took first and second prizes in the Class for Three Ram Lambs. Mr. Lambert sent a nice pen of lambs, with splendid backs, and fine quality of wool; these had many admirers. The position of the prize-pens of ewes is different from that given them at Bristol and Portsmouth.

Suffolks.

The popularity of this very useful variety of sheep appears to be increasing most rapidly in the Eastern Counties, where it is found to be quite as suitable for ranging over the heaths and the large light-land farms as for the enclosed and more productive lands.

There would doubtless have been a larger number than eight

exhibitors had it been earlier known that separate classes would have been established for Suffolks. Now that the Council have had experience of the great and increasing interest taken in the breed, it is hoped that the classes will be continued, and that the members of the Suffolk Sheep Society will make continued efforts to bring before the public in increasing numbers their "coming sheep." There is still a slight want of uniformity in the various flocks, but this difficulty will doubtless soon be overcome by a strict observance of the rules laid down for the admission of entries into the flock-book.

Two very heavy two-shear rams took the first and second prizes for Mr. E. Gittus and Mr. J. Smith. The first prize for shearling rams was given to the Marquess of Bristol's exhibit of true Suffolk character, but somewhat backward in condition as compared with the second-prize winner—a ram with a brownish face and dark wool. The highly commended ram shown by Mr. G. B. Robins was of true character, had a splendid back, and was free from dark wool. The three ram-lambs shown by Mr. J. Smith had an easy win; whilst a pen shown by the Marquess of Bristol might have been placed second, instead of the pen which was honoured by the Judges. These, the second-prize lambs, did not appear to stand square on their legs. A very thick-fleshed and matchy pen of ewes won the first prize, whilst there were four beautiful ewes in the pen placed second. A pen very true to type was sent from the Ickworth Park flock. These were highly commended, as were the other two pens exhibited, so that the whole class was highly commended. The ewe-lambs, like their brothers, were not so forward in condition as is usually the case at this time of the year; the cold and backward spring had affected them, as it has done most of the exhibits in the Lamb Classes.

Other Short-woolled Breeds.

For eight prizes offered, there were but six entries from two exhibitors—Mr. F. Shepherd and Mr. S. Kidner—whose sheep were quite worthy of the prizes so easily won.

Cross Breds.

This Class for Lambs may or may not be in place at a Show of breeding-stock; it seems possible to find a better use for the 35*l.* given.

Report of the Judges of Hampshire Down, &c., Sheep.

We beg to report that the Hampshire Classes were good on the whole, especially the *Shearling Rams* and *Ewes*, but there was rather too much wool left on the latter.

We were pleased to see a good show of *Suffolks*. The *Two-shear Rams*, although small in number, were good. The *Shearling Ram* Class was well represented, but some showed a little too much of the Hampshire type.

The *Shearling Ewes* were a grand lot, and gave the Judges much difficulty in giving their awards; this applies also to the *Ewe Lambs*.

As the *Suffolks* were well represented, and there were many excellent sheep amongst them, the Judges trust that the Council will continue to admit them as a class to the Royal Society's Shows.

CLASSES No. 146, 147, 148, 149 and 150 had but few entries, but some of the latter were very good.

JOHN SHERWOOD.
J. W. STANFORD.
GEORGE KING.

Report of the Judges of Shearing and Trimming.

We, the undersigned, as your Inspectors of Shearing and Trimming, beg to report the result of our examination on Saturday. We consider the trimming of lambs should only mean such as should be calculated to deceive the Judges in their examination and decision of such stock; and we would venture to recommend that the mere cutting of the wool across by the end of the tail, should not mean disqualification, as we find that most breeds of stock in this district are so treated in the regular and ordinary way; and we further add that we are of opinion it would be much against the interests of the Royal Agricultural Society to put their present rule in force, as we did not find one pen of lambs in the Yard free from this—"The cutting of the wool across the tail, and a little less or more under, so as to keep them clean and in good order," and would much recommend, as your Inspectors, that they be thus allowed to come before the Judges for such prizes as are offered to them in the various classes.

In our inspection of last year we found many of the best lambs trimmed all over to a large extent, and we did, on that account, recommend disqualification.

We have further to lay before the Council the satisfactory state of shearing in the Yard, as we only found Nos. 1252, 1257, and 1258 in Class 121, and also 1275 in Class 124, that we could recommend for disqualification, and we do this, knowing that those have not been fairly shorn according to the rules of the Society, and to the instructions given to us as your Inspectors.

WILLIAM JOBSON, } *Inspectors of Shearing.*
J. B. WORKMAN, }

PIGS.

It was generally considered that the pigs shown in the Classes for Large, Middle, and Small Whites were as a whole superior to the exhibits in the same classes at the last three Royal Shows, but not equal in merit to the displays of the porcine tribes seen at some earlier exhibitions of the Society. It was also observed that although the Norwich Show might be pointed to as the one at which an improvement was noticeable in the pigs exhibited, yet not a single prize for White Pigs was retained in the counties of Norfolk and Suffolk. This is a matter of surprise to those who remember the splendid Small

White pigs sent in years gone by to the various Showyards by Messrs. Hobbs, Stearn, and Sexton. Is the cause for this to be found in the changed taste of the public, which appears now to prefer pork with a greater proportion of lean meat? Or to what causes are we to look for this somewhat remarkable fact? It may be said by some persons that Norfolk is not a county in which many stock are bred; this can be only partially correct, as several Champion animals were bred in the county, and why should not some of the prize pigs have been produced at home? I confess that I am unable to find a sufficient reply.

The classification of pigs has recently been altered, and in my humble opinion considerably improved. I should like to see still another alteration; this is the addition of classes for sows in-milk or suckling their produce. Many of the prize sows may have produced litters of live pigs in the time required by the rules of the Society, but it is very doubtful if many of them have satisfactorily performed the later duties of a mother. A sow which has recently reared a good litter of pigs is heavily handicapped in competition with a young sow of seventeen months, which has not produced a litter of pigs, or one which has not suckled her piglings.

Large White Breeds.

The most successful exhibitor in the Classes for Large White Pigs was Mr. William Hall, who easily won first prizes in the Classes for Boars farrowed in the year 1885, and also for pens of three boars farrowed in 1886. These were pigs of great substance and quality; in fact, just the kind for farmyards and the dairy factories in districts where large pork is in demand. The same exhibitor also showed three very nice yelts, which failed to attract the favourable notice of the Judges. Representatives of the Worsley Hall Stud again appeared in the Royal Showyard after an absence of two years. A second prize was won by them in the Class for Three Boar Pigs, as well as second and third prize for Three Breeding Sow-Pigs, the latter having been beaten by three fully-developed sows shown by Mr. T. Collinson, Jun. The best Class in this section was that for Breeding Sows.

It seemed a very close thing between a splendid sow, with wonderful loin and hind quarters, shown by Mr. James Howard, and a very long and massive sow of Mr. Philip Ascroft's; the Judges eventually placed Mr. Howard's sow first, and placed second a much inferior sow, the property of Mr. C. E. Duckering.

Middle Whites.

This, one of the most, if not *the* most useful of the many varieties of pigs, was not well represented; the first-prize boar, shown by Mr. Walker Jones, possessed some of the points of a Large White, whilst the winner of the second partook more of the Small White character; of the third I say nothing, as it was bred at Holywell. Only two pens of boar pigs were shown. Twelve sows were entered, but several pens were empty. Mr. Philip Ascroft made a clean sweep of the three prizes with very good exhibits; these were not, however, placed in the order which their owner thought correct. In the next Class, a very fine pen of young sows won the first prize for the Earl of Ellesmere; many persons thought Mr. R. Edwards's trio pressed them very hard; but again my modesty prevents an expression of opinion from myself, as they were descended from Holywell stock. Two pens of very thick-fleshed pigs won the third prize and the reserve number for the Aylesbury Dairy Company.

Small Whites.

The cultivation of this once most popular breed appears to be affected by the change in the tastes of consumers of pork. The pigs in the various classes are principally noticeable for their superior quality, their freedom from coarseness, and the fact that the prize-winners all come from the home farms of three members of our aristocracy, viz. the Earls of Ellesmere and of Radnor, and Lord Moreton. This is of itself a sufficient proof of the excellence of the exhibits.

Report of the Judges on White Pigs.

In Class 151—*Large Boars*—the first was a useful pig, the second moderate, and the remainder either very inferior or shown in the wrong class, being of the Middle Breed. For this reason the third prize was withheld.

Class 152—*Young Boars*—were indifferent, if we except the first- and second-prize animals, which were of good type.

Class 153 was good throughout, with one exception, most of the animals showing character and quality.

Class 154 was a fairly good one, the winning pigs being of the correct type, but the remainder were more closely allied to the Middle Breed.

In the Middle Breed Classes, No. 155, for *Boars*, was only moderate, no animals besides the winners being worthy of notice.

Only two pens were exhibited in Class 156 for *Young Boars*, and these were of ordinary quality.

Class 157, for *Sows*, was an extraordinary one, the winners being very perfect examples of the variety; indeed, almost every entry was worthy of notice, the class being a good representation of the Middle Breed.

Class 158, for *Three Breeding Sows* of 1886, contained nothing noteworthy if we except the first- and second-prize pigs.

The *Small White Boars*, in Class 159, were a fairly good lot.

Class 160, for *Young Boars*, contained only two entries, one being a pen of good quality, while the other, which was of the Middle Breed, was not put into the prize list for this reason.

Class 161, for *Sows*, was a most excellent one, containing a number of pigs of great quality, and of the true type of the Small White Breed.

Class 162, for *Young Sows*, contained two pens only, both of which were true in type and good in quality.

Joseph Smith.
Peter Eden.
James Long.

Small Blacks.

The county of Suffolk comes out well in this division; Mr. George Pettit takes a first and three second prizes with very superior specimens of the breed; the same remark applies to the three boar-pigs which won for Mr. J. A. Smith the first prize in the Class, and to the second-prize pen of three boars and the third-prize sow shown by His Grace the Duke of Hamilton and Brandon. The first-prize pen of three breeding sows, shown by the Rev. W. Hooper, were as neat a trio as I ever saw; whilst the first-prize sow of Mr. Duckering's is very good, except that she appeared to have a defective udder, owing to some of the teats being blind, and to an attack of garget from which she had suffered.

Berkshires.

It was scarcely to be expected that the Berkshire variety would muster in any very great force so far from home, still there were some very good specimens of the breed exhibited. In the Class for Boars a very level-topped, deep-sided pig easily won first for Mr. Vincent; a somewhat shorter pig of very nice quality belonging to Mr. Darby taking second prize,—a College pig with a true Berkshire head being third. The three boar-pigs were not good; one of those in the third-prize pen appeared to require an application of paint to the tip of its tail. In the reserved pen of Mr. A. S. Gibson was, perhaps, one of the best Berkshires in the Show; one of its partners was also very good, but the third was lame and crampy. The Judges very justly considered the sows so good, that they favourably noticed eight of them. Mr. Darby won first prize with a sow of beautiful quality; the second prize, bred and shown by Mr. Vincent, was also good, but her skin was not quite of the correct tinge; other very good sows were Major Peploe's third and two unnoticed by the Judges, Mr. Corp's first prize-winner at Bristol, and

Mr. A. S. Gibson's, which was unfortunately lame. Mr. Vincent's first pen of yelts were light in colour and very forward in condition; in the second-prize pen, belonging to Mr. Ponsonby, were two very good yelts, the third was light in neck.

Tamworths.

These good bacon pigs increase in size and fatness at each Show, but the number of exhibitors does not show a corresponding increase. The Aylesbury Dairy Co., who have taken over Mr. G. M. Allender's herd, easily secured three firsts and one second, Mr. Norman, Jun., a first and a second, and Messrs. J. and W. H. Mitchell a second prize.

Report of the Judges on Black and Red Pigs.

Small Black Pigs.

With the exception of the Breeding Sow Class the *Small Blacks* were not strongly represented.

Class 163.—Nos. 1718 and 1717 were very smart good pigs. No. 1720, with a good forehand was plain behind, whilst No. 1725 was a wide, level-taking pig in the pen, but on coming out, showed weakness both in the girth and jowl.

Class 164.—There were several nice young Boars in this class, but in no case did the three match for size. No. 1730, with a drooping heavy ear and spare coat, were still straight good pigs, and could not be passed by. No. 1727, though uneven for size, showed evidence of careful breeding. No. 1726 were a pen of level-backed, handsome pigs, and the class may be described as a very useful one.

Class 165.—This was a very strong class, and contained several animals of great merit; the only numbers calling for special remark were No. 1742, which was really grand, and No. 1734, a very perfect young sow, but in too high condition to take her legitimate place in a Breeding Sow Class.

Class 166.—Excepting the prize pens, this was considered a medium class. No. 1744 was a particularly nice pen and a good match.

Berkshire Breed.

Class 167.—No. 1752 was a strong hardy boar, and fairly shaped, just a trifle coarse; and this would have cost him his position but that No. 1761 had a very white face, whilst his shape and quality were above the average. No. 1754, a square heavy-fleshed boar, suffered in appearance from some injury or misformation across the bridge of the nose. Beyond the prize animals in this class there were half-a-dozen strong active pigs, but many of them not showing the quality and breeding expected in a Royal Showyard.

Class 168.—This class of pens of Three Boars has not brought out such a promising lot as we had hoped to see. They are difficult classes to provide for, but none the less valuable on that account; it is possible that many of the exhibitors were not quite prepared for the competition; we hope to see the prizes continued, as they bring well forward any features of careful breeding as distinct from the results of feeding, and will in time most likely

form a centre where the best young boars of acknowledged purity may be found in good numbers; we are sorry not to be able to give Class 168 as an example now. We felt bound to give the first prize to a pen where one pig had a black tail; but for this, and a want of evenness in size, this would have been a pen fairly representing the breed; the other two prize pens also did not match for size, and we could not commend the rest of the class.

Class 169.—As is usually the case, this was the best-filled class in the whole show of pigs; still, amongst the nineteen entries there was no animal of extraordinary merit. The first-prize sow, No. 1783, had not a stylish-looking head, too long and straight rather, but her body was a very perfect one, level on her back and under, very true along the sides, the best of quality and not over made up, yet having extremely good natural flesh; the second-prize sow was two or three sizes larger, and a trifle coarse; she also had, to all appearance, a good proportion of lean meat, and struck the eye as one of those animals that would pay her way better than many. Nos. 1773 and 1788 were very neat level sows of good quality. The large old sows in this class, although a grand lot to look at in the pens, did not come out so level and attractive as usual.

Class 170.—The pigs in the first-prize pen were of very fair quality, well shaped and of large size, added to this they were a perfect match. There were four or five more useful pens, but in no case did the three match in size, colour and coat.

Tamworths.

The Young Classes were not very prepossessing. The prize animals in the Boar and Sow Classes were very large, and fairly upheld the character of the breed. This hardy race of pigs seems to make one claim only on public favour, that is, the amount of lean meat in proportion to the fat. If it had been the proportion of meat to the weight of bone, they would scarcely make good their claim; nevertheless they show a considerable improvement during the last few years, and if their quality and shape were thoroughly taken in hand much good might be done for the breed, without detracting from the character they have gained.

Hermann Biddell.
Heber Humphrey.

CHEESE AND BUTTER.

It will be observed from the Judge's Report, which follows, that English butter-makers have yet somewhat to learn, not alone in the manufacture of the article, but also in the mode of packing and the proper materials to be used for the packages. The collection of Cheese was not large, yet it appeared to contain several lots of nice quality.

Report of the Judges of Cheese and Butter.

We, the undersigned Judges of Cheese and Butter, beg to report as follows:—

Cheese—*Class* 175.—Fair average quality; same may be said of Class 176, in which there was but a limited competition.

Class 177.—Only one exhibitor, and not being of very superior quality we only awarded it a second prize, considering it not of sufficient merit to entitle it to a first prize, which first prize we withheld.

Class 178.—Fair average quality.
Classes 179 and 180.—Very good.
Class 181.—Fair average quality.
Class 182.—Only three exhibitors. We awarded No. 26 second prize, considering none of them of sufficient merit to entitle any to a first prize.
Classes 183 and 184.—Fair average quality.

In regard to the butter submitted to our judgment, we found *Class* 185 —*for Fresh Butter absolutely free from Salt*—to be, as a rule, of an inferior quality. We think this is to be partially accounted for by the fact that it had been delivered some days previously to the Society; and though we admit that well-made butter ought to stand, and successfully stand this test—still, when we consider the variety of packages, the objectionable cloths and unsuitable wood packages in which they were placed, we cannot wonder that many suffered seriously. We were much surprised to find that one or two lots had been packed in cabbage-leaves—with the result that the butter was rendered quite offensive—and the cabbage-leaves had entered into the category of decayed vegetable matter, which, in conjunction with so very susceptible an article as butter, simply meant its destruction as an article of wholesome food and an appreciated adjunct to the table.

The other *Class*—of *Slightly Salted Fresh Butter*—was of a higher standard, and we were able to award more commendations.

Class 187—*for Packages of Salt Butter*—fell short of the standard we felt it our duty to require before awarding a first prize. This, therefore, was withheld; and we would desire to see a large improvement in this important class, and would wish to record our opinion that exhibitors would do well to bear in mind that neither water nor salt in excess are welcome discoveries to any set of Judges at the present day.

Jas. Watson.
Jubal Webb.
Henry Overman.

XXV.—*Poultry at the Norwich Show.* By Edward Brown, F.L.S., Editor of the 'Fanciers' Gazette.'

With the desire to make the Poultry Section of the Royal Show educational I have been invited to report upon it. But to report in the usual way is not my intention. There are many features which deserve comment, such as the arrangement of the Show, the classification, and the system of judging; but these need not be fully touched upon here, as they would take up the space which I think can be better devoted to another purpose. Thus much I will, however, say, that, both at Preston in 1885, and at Norwich this year, the judging has been on the whole very satisfactory, and I have never seen Shows better judged. There can be no question that the triple system of judging has many advantages. It prevents hasty awards, and causes Judges to think and to discuss their awards before they are made—an advantage which is too often overlooked. Whilst, therefore, there are many things in the Poultry section of the Show which I believe might be improved, it is desirable to adhere to the

judging as conducted at present. The selection of Judges was an admirable one, and proved to be a happy unification of the farmer and fancier elements. Mr. O. E. Cresswell is a breeder of considerable experience; Mr. D. Bragg, a tenant farmer who has found his poultry a valuable part of his farm stock, and who, both by his successes in the production of market poultry, chiefly ducks and geese, and in the Show-pen, has proved that he understands the breeding of poultry most practically. The remaining Judge, Mr. Butler Smith, is also a farmer, the son of a gentleman who, as an exhibitor and a Judge at Royal Shows, is too well known to need more than a mention. Mr. Butler Smith has been a most successful breeder of Dorkings, in one variety of which he has won at nearly all the chief Shows in the kingdom. Considering, therefore, the object which the Royal Agricultural Society has had in recommencing the Poultry Classes at its Annual Show, I think that a better selection of Judges could not have been made.

The Classes at the Royal Show embrace almost all the more useful breeds. Such as are to be regarded as purely ornamental, and which cannot be deemed likely to be of service to the farmer or cottager, are omitted from the list. This is an understandable policy, but it is one which needs careful application, for if only useful breeds are admitted to the Poultry section of the Show, a stamp will be placed upon certain breeds which must not be lightly given or withheld.

It is to be regretted that the Show in point of numbers was a decided falling off from that at Preston last year. This I believe was due to three causes. First, the breeding season of 1886 was a very backward one, and consequently the young classes would in any case have been a failure. But, secondly, these young chicken classes are, in my judgment, a mistake, as July is far too early for the exhibition of chickens, and breeders do not care to have their valuable youngsters confined for the best part of a week. But the third great objection on the part of breeders is to the showing of three birds in one pen. The injury done to the fowls, as shown in several instances both at Preston and Norwich, is irreparable, and even the liberal prizes offered will not be recompense for the harm done to the fowls.

The classes at the Show may be roughly divided into four sections, namely, (1) generally useful fowls, embracing Brahmas, Cochins, Langshans, Houdans, Plymouth Rocks, and Scotch Greys; (2) laying breeds, under which are included Andalusians, Minorcas, Leghorns, and Hamburghs; (3) the table varieties—Dorkings, Crevecœurs, and Game; and (4) Waterfowl, with Turkeys, which comprise the last section. The total number of entries in the whole Show was 191, or an aggregate

of more than 700 fowls—a by no means small collection for the time of year, but one which, with the liberal prize-list given, ought to have been largely increased.

Taking the section first named above—that to which I have given the term "generally useful fowls"—we find that the Brahmas came first. Of these there were sixteen pens entered, one of which was absent. The old birds were a good lot, especially the Darks; but the chickens were backward, much more so than is usually the case at this season of the year. Mr. C. D. Jones's lot of Dark chickens and Mr. R. Butterfield's lot of Light chickens were really wonderful; and their size and condition reflect great credit on the breeders. The Brahma is almost too well known to need any description, but it may be helpful to some if I say that of the two colours the Lights are the better for practical purposes; and when any kind is to be selected for crossing, this ought to be taken for preference. The Brahma is a large heavy fowl and a good winter layer, and though by no means equal to many other varieties as a table fowl, it has good flesh. It is a non-flyer, and will not wander very far. Those who wish to use Brahmas for crossing, or even pure, as an economic fowl, should select birds without the heavy hocks and foot-feathering which is necessary to success in the Show-pen. Some time ago a leading breeder of Brahmas told me that since heavy hocks and foot-feathering became common, he had found that the laying of the birds had sensibly decreased.

Cochins were a capital lot for quality, as three of the best breeders were represented; Mr. G. H. Proctor, by Buffs; Mr. A. E. Darby, by Whites; and Mrs. Goodall, by Partridge; but this breed is only admitted out of courtesy, for though one of the most beautiful of our breeds, and one which has had expended upon it the greatest amount of skill, it cannot be recommended from an economic point of view. It is, however, the most determined of all the sitting varieties, and where sitters are required, it can be crossed to give this quality.

The entry of Langshans was a disappointing one, there being only nine entries, of which two were absent. The quality, also, was but moderate, and with the dispute as to the true type in this variety, there was by no means a uniformity of character. This breed is found by those who have tried it one of the best that the farmer or cottager can select. It is a capital layer, reliable testimony showing that in some instances it averages about 180 eggs per annum; a splendid fowl on the table, with the meat on the breast, not on the thighs, as is generally the case with Asiatic fowls; and a rapid grower. Langshans are fowls which deserve to be encouraged for practical purposes, and

the only objection I can see to them is because of their black legs; but the old prejudice against these is fast dying out.

The breeders of Houdans certainly did not do justice to this breed or themselves, as there were only six entries, of which two were chickens. The quality, on the whole, was very good, and Miss Clayton's winning adults were a capital type of Houdan, though much darker than are preferred in France. The chickens were too young to be more than promising. Houdans form one of the best breeds we possess for ordinary purposes, though it is a non-sitter. Its laying powers have, I am afraid, been somewhat overrated, for M. Lemoine, in the tables which he published at the last Paris Show, only credits it with laying 125 eggs per annum. I thought it would have given a much higher total return than this. It is a capital table fowl, a rapid grower, very tame, and suitable to all climates, doing best on calcareous ground. With the solitary exception of being a non-sitter, the Houdan is certainly the best of the generally useful varieties.

We owe several of the more popular of our breeds of poultry to American enterprise and skill, notably the Brahma and the Leghorn, which, though not natives of the American continent, were first introduced into England through the States. But the Plymouth Rock is actually American, because it was manufactured on that continent. It is only some eight years since it was first brought over, but its intrinsic merits have won for it a popularity which is remarkable, and now the Plymouth Rock Classes are generally the best filled. This was the case at Norwich, where there were twenty-four entries, of which four were absent. The most typical among the old birds were the first and third prize lots, owned by Mr. Jas. Holden and Mr. Edward Anderson respectively. The chickens were well forward, showing the precociousness of the breed. Plymouth Rocks are truly all-round fowls, *i.e.*, they do not excel in any one point, but are good in all. They are capital layers, but the eggs are, like those of all the Asiatics, small in comparison with the size of the fowl. They are tinted, and that is what many people like to see. The birds are good on the table, and have a lot of eating upon them. They make reliable mothers, and can be easily restrained, maturing very rapidly. The flesh is, however, yellow, which is not a recommendation on this side of the Atlantic, although it is in America.

To introduce classes for Scotch Greys at Norwich appeared a risky experiment, for there are very few of these fowls south of the Cheviots, and it seemed too far to send specimens from Scotland. Therefore I was surprised to see eight entries, of which exactly half came from the far north; but one of these was

absent. The representatives of Scotch Greys at Norwich did not do justice to the breed, as they were a long way behind what can be seen at the best Scotch Shows. Mr. Duncan Maclaren's were the best, and that exhibitor deservedly won in both classes. Only a second prize was given for the chickens, of which there was but one pen present. I thought they were quite worth a first. This breed deserves to be more widely known.

We come now to the second group, namely, those which are known as non-sitters, and are specially characterised for their laying qualities; these comprise two great families, the Spanish and the Hamburghs. In the former are the Spanish proper, the Minorcas, the Leghorns, and the Andalusians. Black Spanish were given classes at the Preston Show, but were omitted from the list at Norwich, the reason being, I suppose, that as they have been practically spoiled for economic purposes by the sacrifice of everything to the White face, they are not considered to be worthy of a place. It is also probable that as all Spanish which pretend to be Show birds are trimmed, the regulations of the Society necessarily prohibited their appearance. But the other three members of the family were given classes, and made a very creditable show, though they were not as numerous as I could have wished.

At one time the Andalusian, or Blue Spanish as they were commonly called, were known in many parts of the country, and regarded as one of the best varieties for laying purposes. They have, however, somewhat fallen into oblivion. The reason for this is that blue or slate-coloured plumage is very difficult to maintain, and this fact has made breeders reluctant to take them up to the same extent as some other breeds. The introduction of many new varieties has also called attention off the Andalusian and transferred it to these latter, which often have been less deserving. All things considered, the Show of this variety at Norwich was most creditable, though there were only ten pens. Amongst the old birds the winning lot owned by the Rev. E. O. Bridgeman were decidedly the best, and were capital representatives of the variety. Mr. H. Abbott's and Mr. E. Merrall's were also good. The chickens were not sufficiently forward to show to advantage, and of these I thought the lot owned by Messrs. Leighton and Halliwell the best. The special characteristic of the Andalusian is being a layer, and a recent writer on the breed says that he has had many pullets, which have laid upward of 250 eggs in a year. The eggs are also very large, and in some of the best strains hens' eggs will only run about six to the pound. None of the Spanish family can be regarded as great in meat qualities, but the pullets are

fine in flesh, carrying it in the right place. The weight of a fair-sized cock is 7½ pounds, and that of a hen 5½ pounds.

Minorcas are perhaps the most valuable of all our laying breeds. These have been developed most largely in Devon and Cornwall, whence their progenitors were probably taken direct from the shores of the Mediterranean Sea. They have of late years come wonderfully forward, and having all the qualities enumerated as belonging to the Andalusian, and being also hardier, they can be recommended to all who wish for layers—in which respect they are extraordinarily prolific. They are black in plumage, have a large comb, a sweeping tail, and are about the same size as the Andalusian. Eleven pens were exhibited at Norwich, of which only three were chickens. For practical purposes I thought that the third-prize lot in the Adult Class were the best. These were owned by Mr. Henry Abbott, a Norfolk farmer. Mr. William Snell's winning pen were a fine lot, and also the birds in the reserve pen owned by Mr. L'Estrange. In the Chicken Class, Mr. Dominy's winners were decidedly the best; but those shown by Mr. Henry Abbott, to which the second prize was given, were a fine well-advanced useful-looking lot.

Leghorns also came out very well, and there were fourteen entries in the two classes, of which only one was absent. Here, strange to say, the chickens were the most numerous. There are two varieties of Leghorns commonly kept in this country, but in America and Denmark others have been introduced. These two are the Whites and the Browns, and at Norwich the exhibits were pretty evenly divided between the two. The best lot in the Adult Class was the second-prize Whites, owned by Mr. John Berry, and the reserve lot were also nice Whites, though somewhat small. Mr. Bradbury's Brown Chickens, which won the first prize, were capital, and Mr. Berry's second-prize Whites were also very good. Leghorns cannot be called quite so good as either the Minorca or the Andalusian, but only because the egg laid is smaller. The quantity produced is quite as great, if not greater. Of the two varieties the Whites lay the larger egg, and are preferred by many to the Browns on that account. They are hardy, of a medium size—I should prefer to see them larger—and the flesh is fair. Where the object is to produce eggs for the market or home consumption, any of the three varieties of Spanish fowls will be found to meet the needs, whether they are kept pure or crossed.

Of all varieties of laying fowls the Hamburghs are the most prolific, but the eggs have the very decided weakness of being small, too small for market purposes. The Blacks are the best in this respect, and are less of a fancy fowl than are the other

varieties. The giving, therefore, of separate classes to Blacks was a right step, and the eleven pens present made a decent show. The quality was, on the whole, good. The winning adults were real beauties. They were owned by Mr. Heath, and the second, Mr. E. Merrall's, though not so smart, were a useful lot, and, from their appearance, I should think they were good layers. The Black Chickens were rather backward. The entries in the Any Other Variety Class of Hamburghs were few, and the quality was not remarkable. For practical purposes the best of these other varieties are the Gold and Silver Spangled.

The entries in the Table Fowl Section were very disappointing. Six classes were provided for Dorkings, and in these there were only nineteen entries, of which one was absent. The adults were the worst of all. Mrs. Wacher's winners in the Adult Coloured Class were the only really good pen therein. Size evidently decided the matter in coloured chickens, as I liked the second lot better, and think that they will prove to be the superior. In the Adult Silver-Grey Class, Mr. Roe's first-prize pen were decidedly the best, and were large, short-legged fowls, not perhaps such as we generally see in the Show-pen, but of a most useful type. Both lots of Silver-Grey Chickens were fair. In the Any Other Variety of Dorking (Adult) Class, all except the third prize-pen were Whites, and that was a lot of Cuckoos. Both pens of chickens were Whites. As to the merits of Dorkings nothing need be said. Their position as the best of all our English breeds of table fowl is undisputed, and it is greatly to be regretted that a better display was not made at the Norwich Show. Dorkings can only be kept under favourable conditions, and it would be inadvisable for any one who cannot supply these conditions to attempt to keep them. They need a dry warm position, the latter being more necessary than the former, for Dorkings are kept very largely in Scotland, where cold predominates. All Dorkings are large, rich in flesh, and have the meat on the breast. The coloured are thought to be the best, and where they cannot be kept pure, they may be crossed with a hardy breed to secure the needed stamina. They lay large eggs, but do not average more than 90 per annum.

Classes were given for Crevecœurs ; but there were only five entries, one of which was absent. In adults, Mr. John Ainsworth's winning pen were first-rate, large, massive, and in nice condition, altogether a very typical lot. After these the rest were moderate in quality. There was only one pen of chickens, Mr. Calvert's, a good lot, well forward, to which the second prize was awarded.

The Game Classes must be regarded as an entire failure, for there were no entries in the two Classes for Chickens. This is due to the objection of breeders to exhibit valuable birds under the present conditions. In the Class for Adult Reds there were six entries. The winning pen of Black Reds, owned by Mr. R. H. Holden, were fair in quality, and that is all. Mr. Martin's second-prize Brown Reds were better from every point of view, better for the production of table poultry, as well as better in the Show-pen. All the three lots in the Any Other Variety Game Class were Piles, and were rightly placed. It is here to be noted that the best variety of game for crossing is the Brown-Red, which has all the elements of a fine table fowl.

The fourth and last section into which the Show can be divided was that for Water Fowl and Turkeys. Here there was also a small show. Ducks numbered twenty-one pens in the six classes, of which three were absent. In adult Aylesburys Mr. W. Weston won with a large capitally shaped lot, of course a little rough at this season of the year, but well deserving their place. The second, shown by Mr. Snell, were nearly as good, but smaller. The Ducklings made a very nice trio of pens, the quality in all of which was remarkable. Both Mr. Fowler's and Mr. Weston's were wonderfully forward, and the Duke of Hamilton's, though smaller, were beautiful. Rouens made a better turn out, numbering ten pens. They were not, however, so pleasing in appearance as the Aylesburys, their varied colours at this season not being bright. The fact that Rouens take longer to mature than do the Buckinghamshire fowls was the reason for their better appearance. Mr. Wakefield won well in both the Adult and Young Classes. In the Any Other Variety of Duck Class for adults, first were a good lot of Pekins, owned by Mr. Snell. This breed is capital as a layer and very useful as a cross, but it has not fulfilled the promise made on its first introduction. Mr. Rogers was second with a good lot of the rich-fleshed but small Black East Indian, and the Duke of Hamilton was third with a decent trio of the Ornamental Carolinas. The only entry of Ducklings was Mr. Fowler's Pekins, which deservedly received the first position.

There were but two entries in the Adult Geese Class, and not one in that for Young Geese. The winning pen was Mr. Snell's Toulouse, a large good pair, and, second, the Duke of Hamilton's Embdens.

In the Turkey Classes, those for any other colour than black or bronze had no entries whatever, and out of the six entries in the black or bronze two were absent. The winning pen in the adults was a very fine lot owned by Mr. Kendrick, jun. The youngsters were far too juvenile for a Show-pen, and it cannot

be advisable to exhibit ten weeks' old Turkeys. The failure of the Geese and Turkey Classes is to be regretted, and is surprising in the Eastern Counties, which are supposed to be the home of these fowls. The reason for this ought to be sought out, in order that the cause may be removed in future Shows.

The Poultry Show in connection with the Royal Agricultural Society appears to have great possibilities in it; but it will be necessary to secure the co-operation of those who are enabled to send the best type of stock. I can vouch for the fact that there is a desire on the part of poultry-breeders to support the Royal Show; and as I believe that it will be the means of doing very great good, I hope this support may be secured.

XXVI.—*The recent appearance of the Hessian Fly*, Cecidomyia destructor (*Say*), *in Great Britain.* By Miss Eleanor A. Ormerod, Consulting Entomologist to the Royal Agricultural Society.

On the 27th of July information was sent to me by Mr. George Palmer, of Revell's Hall, near Hertford, of a severe attack of a kind which had not previously been noticed, which was then occurring to barley on land in his occupation; this attack has proved to be that of the gnat midge, commonly known as the Hessian Fly, and scientifically as the *Cecidomyia destructor*, of Say, and is, as far as is known on reliable authority, the first recorded instance of its appearance as a corn pest in Great Britain.

On examining the specimens sent, and also, on the 30th of the month, examining the injured crops in the fields at Revell's Hall, I found that the infested barley-stems were doubled sharply down above the second joint from the root (see Fig. 2, p. 722), and between this double and the joint below, and between the stem and sheath, the chrysalis of the maggots which had been feeding were very plainly visible (see Fig. 1, p. 722). These were about the eighth to the sixth of an inch in length, bright brown in colour, and oval in shape, somewhat pointed towards each end, and much flattened, so as to bear a great resemblance to a "flax-seed," by which name these Hessian Fly chrysalids, or pupæ, are commonly known in America.

These chrysalids were further distinguishable by having one of the flat sides pinched in near the end as if by the pressure of a nail, and shortly after, as they matured, they became some-

what narrower in form and marked with parallel striæ from end to end.

The injury to barley was most noticeable in a field of 33 acres, and an adjacent field of 15 acres, which were on a gravelly or stony soil on exposed rising ground; on another neighbouring field which was cooler, less exposed, and altogether better land, there was a much smaller proportion of injury. There was some amount, but not much, on a neighbouring wheat-field.

On the 2nd of August, Mr. Palmer reported that other neighbouring farms had been found to be infested, and from subse-

Figs. 1 and 2.—*Illustrations of Barley Stems infested with the Hessian Fly.*

Fig. 1.

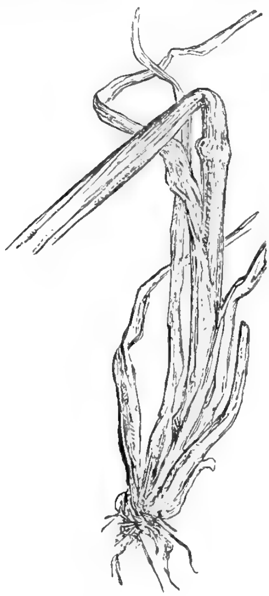


Fig. 2.

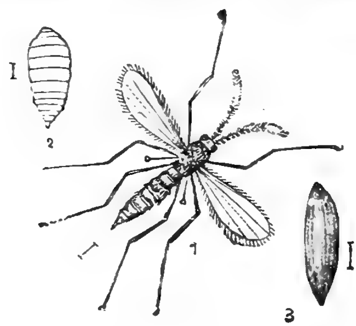
quent investigation, up to the present date of writing, the pupæ of the Hessian Fly have been found by Mr. G. Palmer or Mr. H. Dorrington, of High Mead, Hertford (both of whom I know to be thoroughly able to identify the attack), at the following localities:—three farms near Hertford; one near Ware; two near Hitchin; and one near Luton, Beds. I have myself been able to identify similar attacks from a farm near Romford, Essex, also specimens have been sent to me from a locality near Inverness, and near Crieff, Perthshire, together with a communication from a member of the staff of the 'North British Agriculturist,'

mentioning that insect-injured straw of this nature was exceptionally common in Scotland this year, and that the attack had been observed in various counties widely apart, and was causing considerable havoc to crops and anxiety to farmers.

In regard to the insect cause of this evil, I have been able to examine it in all its stages from the maggot taken out of the newly formed chrysalis cases up to the perfect gnat midge developed from the "flax-seed"-like chrysalids in my possession.

The maggot (that is, technically, the larva), as dissected out of the pupa case, whilst still but little, if at all, altered from its original condition, was legless, and milky white, with a line of slightly darker tint down the middle, and also across the divisions of the segments; it was oval in shape; about the eighth of an inch long; the head, as matter of course, was not visible; but underneath the maggot, near the head end, I found a well-developed "anchor process"—a kind of horny blunt fork or scraper, with which maggots of this nature are furnished, the form of which aids in distinguishing the species. I found this process to be decidedly different in form to that of our British wheat midge, the *Cecidomyia tritici*, being much more forked in shape.

Fig. 3.—*Hessian Fly in its Stages of* (1) *Gnat*, (2) *Maggot, and* (3) *Pupa or "Flax-seed," all magnified.*



The natural sizes are shown by lines near each figure.

The first gnat midge, that is to say the "Hessian Fly," the *Cecidomyia destructor*, was found developed from my pupæ on the 8th of September, this being as nearly as may be six weeks from the first observation of these "flax-seed" pupæ.

To the unassisted eye it appeared as a small stout-made brown gnat, darker in the head and fore-body, somewhat lighter in the colour of the legs, with one pair of smoky grey wings fringed at the edge, long fine horns, and it was precisely one-eighth of an inch in length (see Fig. 31).

As seen under a one-inch object-glass, the eyes and head were black, the fore-body black, with yellow or pale-brown patches below the insertion of the wings, and in front, on the side of the body. The abdomen at this date (that is, about eighteen hours after first observation) was of a raspberry colour, paler below, and above only showing this colour at the divisions of the segments; these were banded across the back with a black or dark tint, and on each side of the six segments nearest the fore-body was a small black velvety patch; the two terminal segments of the abdomen and the ovipositor were of a pale brown or yellow tint. On the second day of examination the red tints were changing to brown; and on the third day, when the gnat midge was quite dead, the tints had deepened further in shades of brown.

The three wing veins were longitudinal (as shown at Fig. 4, as the neuration cannot well be conveyed in the smaller figure); the peculiar form of the third nerve is a characteristic of this species. The wings are sprinkled with small scales, and with hairs of different form and length, some of which are conveyed by the line of dots in the figure of the fly. The antennæ or horns are distinctly beaded, the two lowest joints being broader and shorter than the others, and the joint at the tip much longer than the preceding.

Fig. 4.—*Wing of the Hessian Fly, showing its neuration.*

I am informed by Mr. R. H. Meade, who at my request was good enough to make a microscopic investigation as to the presence of two small lamellæ on the ovipositor, that these were absent, which is another characteristic of the female of the *C. destructor;* and after minute watching and examination, with powers from ordinary magnifiers up to a quarter-inch focus, at intervals during more than two days, so as to secure notes of the appearance of the insect during its changes of colour up to development and immediately after death, and likewise details of points of external structure, and comparing these with the authorised descriptions given by the leading American and German Entomologists who have written on the subject, it does not appear to me open to doubt that this gnat midge is the true Hessian Fly, the *Cecidomyia destructor*, of Say.

This matter being one of great agricultural importance, I take leave to mention that I have been confirmed in this view by the valuable opinion of Professor Westwood, Life President of the Entomological Society of London; and that of Professor W. Saunders, President of the Entomological Society of Ontario,

Canada, to whom I submitted specimens of injured straw and of the "flax seed" pupæ; and with regard to the developed fly, by the equally skilled opinion of Mr. R. H. Meade, of Manningham, Bradford, well known for his investigations regarding the determination of species of diptera, to whom I submitted the specimen.

The details by which this attack is to be kept in check must differ according to circumstances,—but the principles are these:—

Destroy the flax-seed pupæ, if this can be done by cutting the crop high, and burning the infested stubble. If this cannot be done, destroy the pupæ, where and how this can be managed, by taking care that the straw is so treated that the flax-seeds cannot develop in the manure; and if for certain prevention, the chaff also should be similarly treated; for though if used as food the pupæ in it may thus be destroyed, yet it is possible that they may have developed to flies, and be spreading evil on all sides, before the chaff is consumed. The plan of what is called in America, "bait," is extremely likely to be of service; this is, where bare barley-stubbles are not collected and burnt, to leave them untouched for about six weeks from harvest; thus all of the Hessian flies which have developed, will, in all probability have laid their eggs on the young plants sprouted from self-sown corn; and, by turning sheep on, the eggs will be destroyed by means of the sheep eating the leaves, and such maggots as have established themselves at the centres of the plants, will (if they escape being cleared by the sheep) be destroyed by means of the plants that feed on them being rooted up and killed by careful cultivation following the sheep. Sheep having fed in autumn or spring, either wheat or barley which had been attacked, the land would be improved by nitrate of soda, or some other stimulating dressing following.

Dressings of lime, or of soot and lime, or anything else obnoxious to the maggot, are eminently desirable where attack shows, as may very frequently be the case on young barley-plants in clover-stubbles. Such materials, properly applied, run down in solution to where the maggot is sheltered, and while they are bad for it, they are very beneficial to the clover.

All applications, measures of cultivation, &c., suitable to secure a healthy and hearty growth are of service, as thus (in case of the attack from flies now developing), the young plant will push on good shoots after the time for egg-laying has passed, and,—in the case of the attack of the April and May brood, which deposits at the first or second joint of the growing

straw,—a good healthy plant will have power to grow past slight injury.

Absence of wheat, barley, or rye, as a succeeding crop on land which has been infested, is a most important point. I am not aware that oats suffer under attack, but all crops other than cereals are safe. The kinds of corn which are firmest in the stem are considered least subject to attack, probably because the mouth parts of the maggot are so minute that it cannot effect serious injury where there is much silica in the straw.

There is one point to be considered further which is of the very highest importance.

Although the *Cecidomyia destructor* has been known as a corn pest of the most serious kind in various parts of North America for more than a hundred years, and has also been known for (say generally) half that time on the continent of Europe, and some of the Mediterranean islands, yet we do not know of it having occurred in Britain,—whence then has it come? It is quite possible that the pupæ may have been brought in infested straw and carried on to the ground in unrotted manure; but my own fear is, as far as I can judge from information gained in the infested district of Hertfordshire up to the date of writing (Sept. 27) that it may be imported in screenings of wheat or barley from Russia, America, or other countries liable to Hessian fly attack.

I am aware, besides, that the general coincidence of attack, and of the presence of foul corn in the infested district; of its special occurrence at one farm where the the feed corn was used, and I am now endeavouring to procure details from competent reporters on this subject, both with regard to imported straw and likewise to the use possibly made of sweepings of damaged and infested wheat or barley from corn ships. The corn to be suspected is what is now being, or shortly, or during the winter will be, exported; because the Hessian fly is recorded as hybernating in Russia in its pupal state, consequently may easily be conveyed in the material wherein it lies.

As the attack of Hessian fly has never before been recorded in England on any reliable authority, there is reason to hope that there are climatic reasons against its thriving in this country, and that by judicious enquiry leading to a knowledge of how it is now being brought in, we may at small expense rid ourselves of this addition to our agricultural burdens. But it should be borne in mind that as yet only a small proportion of those whose interests are at stake are well enough acquainted with the attack to discriminate between it and the other corn injuries, and it is of the highest importance that no reports

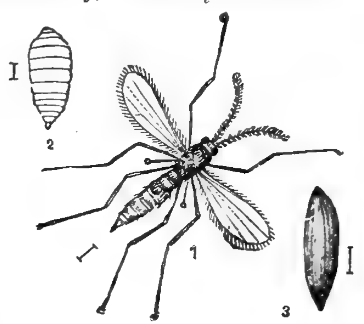
should be received or acted on which have not been subjected to most stringent examination.

XXVII.—*Official Reports on the Hessian Fly*, Cecidomyia destructor (*Say*). By CHARLES WHITEHEAD, F.L.S., F.G.S., of Barming House, Maidstone.

[Published by the Agricultural Department of the Privy Council on the First Appearance of the Insect.*]

The following suggestions have been prepared by Mr. Charles Whitehead, F.L.S., F.G.S., at the request of the Lords of the Committee of Council for Agriculture, for the information of Agriculturists.

The Hessian Fly, Cecidomyia destructor (*Say*).



1. The perfect fly much magnified. 2. Larva magnified.
3. Pupa magnified. Lines showing natural size.

"This insect is terribly destructive to corn crops in America, Canada, and parts of Germany. In some years it has almost entirely destroyed the wheat crops in large districts in these countries. In the upper counties of Georgia, Packard states, 'the fly has committed such ravages upon the wheat as scarcely to leave enough seed for another year.'

"It had not been found in Great Britain until this present year, though in 1800 fears were entertained that it had been introduced.

"In 1788 the importation of wheat from America was prohibited by the British Government, until it was ascertained that it was not likely that the insect could be brought over in this way.

"Now, however, without any doubt, it has appeared here, and all effort must be made, and at once made, to stamp out this dangerous intruder. To effect this, if possible, information is given below as to the nature of the attack of the Hessian fly, and a description of it in its various stages, as well as methods of preventing it from spreading in this country.

"*The signs of the Attack.*—The plants of wheat and barley infested with this insect turn yellow, and become stunted and unhealthy. Plants upon sharp gravelly patches, 'pinnocky places,' 'stonebrash,' or 'stone-shatter,' and upon the poorest parts of fields, show the attack first and most seriously. As the plants ripen the straw becomes root-fallen and scrawled, the ears are small, and the grains misshapen and shrivelled. Corn plants thus affected

* Reprinted by permission of the Privy Council.

should be carefully examined, especially their leaves, or blades, just at the points where they cover the second joints of the stems from the ground.

"*The Description of the Insect.*—Upon corn plants thus injured either the larvæ (Fig. 2) of the Hessian fly, or its pupæ (Fig. 3) will be found close to the lower joints between the stems and the leaves, or blades.

"The larvæ, which are the authors of the mischief, as they suck out the juices of the plants, are clear white, or translucent, maggots, about the eighth of an inch long, having stripes of a greenish hue under their skins. They remain in this state from four to six weeks, and then assume pupal, or semi-pupal, form.

"The pupæ are called 'flax seeds' in America, because they are like small, elongated flax seeds. They are a little longer than the larvæ and are of a chestnut colour. It is in this state alone that the Hessian fly has been seen in England.

"These pupæ are unmistakable, and when once discovered, immediate steps should be taken to prevent them from turning to flies (Fig. 1), which would lay eggs upon the corn plants either in the coming autumn or in the spring.

"*Methods of Prevention.*—Crops of wheat and barley in whose straw the 'flax seeds' have been found should be cut above the second joint, either by setting the reaping machines high, or by reaping them by hand so as to leave a long stubble. Where barley is short and must be cut with scythes, the mowers should be instructed to keep them as high as possible.

"Land upon which the crops have been infested should be cultivated, or broad-shared, immediately after harvest. The stubble and rubbish should be collected most carefully, and burnt. After this the land should be deeply ploughed. Or, the stubble might be ploughed in at once deeply.

"Straw from infested fields should be closely inspected when thrashed. If pupæ are found, the straw should be used on the spot, if possible, for litter, and all passed through mixens that heat may destroy them.

"The chaff and 'cavings' from such straw should be burnt, and the corn screened in the most careful manner. Corn from infested fields should on no account be used for seed.

"Where manure is obtained from the cowsheds and stables of London and other cities and towns, it should be mixened for some time, as it is very probable that the pupæ of the insect might be imported in packing cases and with straw crates from America and Canada.

"Wheat plants and barley plants that show yellowness and other signs of disorder in the autumn, or spring, should be closely examined for the larvæ or pupæ of the Hessian fly.

"Should it be discovered that the larvæ, or maggots, are injuring young wheat plants in November, or that pupæ—'flax seed'—are present upon these, it would be well to feed them down hard with sheep.

"CHARLES WHITEHEAD."

Supplemental Suggestions.

The following supplemental suggestions have been prepared by Mr. Charles Whitehead, F.L.S., F.G.S., at the request of the Lords of the Committee of Council for Agriculture, in consequence of the recent appearance of the Hessian fly, in its perfect, or fly, form.

"Since the preparation and issue of the suggestions concerning the Hessian fly, the perfect insect, or fly, has been seen to come from the pupa, or 'flax

seed,' found in the stems of wheat and barley plants. It may, therefore, be assumed that this insect will be of a double brooded habit in this country, as it is in America and Canada, and will attack wheat plants in the autumn, and wheat plants and barley plants in the spring and summer.

"The fly, as it has appeared lately in England, corresponds exactly with the descriptions of American entomologists, and eminent English authorities have pronounced it to be the Hessian Fly, *Cecidomyia destructor* (Say). It resembles a tiny gnat, being about the eighth of an inch long. Its body is brown, with the head and fore part of the body of a rather darker colour. The wings are grey, or smoke-coloured, and have long fine fringes around them, with peculiar veins characteristic of the *Cecidomyiæ*. Its long horns, or antennæ, are like strings of beads.

"As soon as the wheat plants are up in the autumn the flies will lay eggs upon them. Larvæ, or little white maggots (Fig. 2), will be hatched from them and attack the plants, living on them until they turn to pupæ (Fig. 3), in which form they will pass the winter. Flies will come from these pupæ in the spring and deposit eggs upon wheat plants and barley plants. Larvæ proceeding from these eggs will injure these corn plants in the manner observed recently near Hertford, Inverness, Perth, and in Essex, and elsewhere.

"Farmers, and especially those who are in or near districts that were infested this year, should watch their wheat plants in October and November, and examine them for larvæ between the stems and the blades. Should larvæ be found, dressings of soot, or of soot and lime, or of guano, would check their operations. Wheat plants upon which larvæ are seen in the autumn, or upon which pupæ are found in the winter, should be fed closely down by sheep in the early spring, if possible. Heavy rollings with ring or ordinary rollers would be advantageous.

"It is most important to burn infested stubble or to plough it deeply in at once, to prevent the flies from being generated. In the case of 'seeds' where stubble is much infested it should be brushed off with poles, or even with scythes in bad cases, and collected as closely as possible for burning by means of 'dew rakes.'

"CHARLES WHITEHEAD."

"*14th September*, 1886."

XXVIII.—*Notes on the Cultivation of Tobacco in the North-West of Europe.* By H. M. Jenkins, F.G.S., Secretary of the Society and Editor of the "Journal."

In 1782 the cultivation of Tobacco in England was finally prohibited by law, but after the lapse of rather more than a century, experiments are now being made with a view to ascertain whether, under the altered conditions of marine transport and the more refined taste of smokers, English-grown tobacco can compete in flavour with that imported from warmer climates, and thus realise a price which will make its cultivation and curing remunerative to the growers. The following are the regulations issued by the Treasury under which the experiments are allowed to be made :—

Under authority from the Lords of the Treasury the experimental cultivation of Tobacco is to be permitted in the United Kingdom.

An occupier of land, intending to plant Tobacco, must, on or before the 5th of May, give notice to the Secretary of Inland Revenue, Somerset House, setting forth the extent of the land to be planted and the place, parish, and county where situate.

Bond under approved securities will be required in a penalty of 100*l.* if over an acre of ground is cultivated, and 50*l.* if under an acre, in order to secure that all Tobacco grown and gathered shall be removed to drying-room and kept there until properly cured, when it shall be packed in bags, bales, or casks of an approved size, and it must then be weighed by a Revenue Officer. After weighing the packages, the duty must be paid, or the Tobacco be deposited in an approved Customs or Excise Warehouse.

> Know all men by these presents that We are held and firmly bound unto our Sovereign Lady Victoria by the Grace of God of the United Kingdom of Great Britain and Ireland Queen Defender of the Faith in the sum of to be paid to our said Lady the Queen her heirs or successors for which payment well and truly to be made we bind ourselves and each of us and the heirs executors and administrators of us and of each of us jointly and severally firmly by these presents. Sealed with our Seals.
>
> Dated this day of in the year of our Lord one thousand eight hundred and eighty .

Whereas the Commissioners of Her Majesty's Treasury have consented to allow the cultivation of Tobacco as an experiment in the United Kingdom by such persons as may receive permission from the Commissioners of Inland Revenue (hereinafter referred to as the Commissioners) subject to such Regulations as shall from time to time be prescribed by the Commissioners notwithstanding the provisions of any Act of Parliament prohibiting such cultivation. And whereas the above bounden has applied to the Commissioners for permission to cultivate Tobacco on a certain piece of land not exceeding in the Parish of in the County of and the Commissioners have consented to grant their permission subject to his entering into the above written Bond or Obligation. Now the condition of the above written Bond or Obligation is such that if the above bounden do and shall from time to time remove all Tobacco grown and gathered upon the said land to a drying-room approved by the Commissioners for the purpose and do and shall keep the said Tobacco therein until the same shall be properly cured and do and shall then pack the same in such packages as shall be prescribed or approved by the Commissioners and do and shall permit all such Tobacco to be weighed by the proper Officer of Inland Revenue and do and shall immediately after such Tobacco has been so weighed pay to the Commissioners or to such Officer of Inland Revenue as they shall appoint to receive the same duty in respect thereof to be charged in accordance with the rate of duty of Customs upon Tobacco of a like description in force at the time of payment or remove the said Tobacco with all due diligence and despatch to a Warehouse duly approved as a Warehouse for the deposit of Tobacco without payment of duty and deliver the same and every part thereof without alteration or diminution into the custody or possession of the proper Officer of Inland Revenue or Customs there. And if the said do and shall from time to time and at all times permit any Officer of Inland Revenue to have full access to the said land and to any room in which any such Tobacco shall be and do and shall observe and comply with all regulations prescribed by the Commissioners in relation to the cultivation

of Tobacco in the United Kingdom then the above written Bond or obligation to be void or else to be and remain in full force and virtue.

Signed sealed and delivered by the above bounden,

In the presence of

As the experience of any one year in our variable climate would not be deemed conclusive, the Council of the Society have asked me to publish at once the notes which I possess on what may be termed the field or farming portion of the subject, and upon the processes of curing which I have seen employed this autumn in Holland, Belgium, and the North of France.

Tobacco belongs to the natural order *Atropaceæ*, or Deadly Night-shade Order, and is closely allied to the *Solanaceæ*, or Potato Order, with which, indeed, it was previously united. The former order contains a large number of poisonous plants, including the deadly night-shade, henbane, mandrake, and stramonium, as well as tobacco, the scientific name of which is *Nicotiana*, in compliment to M. Nicot, who first introduced the "weed" into France. There are several species and a multitude of varieties of *Nicotiana*, but those generally grown in the north-west of Europe are the *N. tabacum* and the *N. rustica*, the former having red flowers and the latter yellow ones. The seedsmen's varieties, as advertised by Messrs. Vilmorin, Andrieux, and Co., of Paris, * take their names from the various American States and certain European and Asiatic countries, *e.g.*, Connecticut (vars. Belknap, and Hockman), Havannah, Kentucky, Maryland, Virginia, Oronoko, Indian, Hungarian, Turkish, Muscat, &c. The Dutch authorities have two special subvarieties of *N. tabacum*, known respectively as "Amersfoort" and "Nijkerk." The Belgians classify the tobaccos of Virginia, Maryland, Cuba, and Havannah under the head of *Nicotiana petunoïdes*, which is easily distinguished by its white flowers. These varieties do not succeed so well in Belgium, nor, as I am informed, in Holland, as the varieties which have been produced by selection in those countries during a long series of years. In Belgium the principal sorts are the "Croquard," the "Philippin," "Batavia," and a newer one of doubtful value called "Saint-Pol."

Mr. de Laune, of Sharsted Court, Sittingbourne, Kent, has experimented this year upon twelve varieties, namely, Macrophylla, Florida, Glasner, Caine's Seed-leaf, Hester Virginia, Kentucky, Connecticut, Pennsylvania, Maryland Broad-leaf,

* In the price-lists of English seedsmen, I have not seen tobacco seed quoted except for ornamental purposes as a sub-tropical plant.

Big Frederick, One-sucker, and Island Broad-leaf, several of which are not known on the European Continent, but have characteristic American names. Messrs. Carter and Co. are experimenting with 17 varieties, which include all the foregoing, except the Macrophylla, and in addition the Havannah, Yellow Prior, Virginian, White Burley, White Stem, and Yellow Oronoko varieties. The results of these experiments, and of those made by Lord Walsingham in Norfolk, Lord Harris in Kent, and others, cannot be thoroughly ascertained until next autumn, as it requires about eighteen months to complete the whole process from the sowing of the seed to the ultimate manufacture of tobacco. Mr. de Laune has been so good as to promise to prepare a complete Report upon his experiments and their results for publication in a future number of this 'Journal.'

Before entering into technical matters, it is most desirable to say a few words on the subject of climate, because tobacco is not a hardy but a sub-tropical plant. I consider it useless to quote the dates or the methods of the various operations connected with the cultivation and curing of tobacco in America and the South of France, in the Levant or in India, although I have noticed that English writers on the subject within the last few months have drawn their illustrations from any country in which tobacco is grown without reference to its climate or its fiscal arrangements. In support of my view, I may mention that last August, being in Bordeaux, I called upon the "Directeur des Tabacs" for that district of France, and asked him to give me a copy of the regulations issued by the French Government to the authorised growers of tobacco in the Gironde, and I explained why I preferred my request. He replied, "I will give you the document with pleasure, and any other information you may desire, but I would recommend you not to act upon the rules or upon my information, because you will only mislead yourself and probably mislead others, as there is probably no plant so sensitive to climatic influences as tobacco. I should recommend you to study the subject in the Departments of the Nord and the Pas de Calais, which are the only two departments in France likely to furnish you with useful information." This is precisely the view that I have always taken, not only in reference to the subject of this paper, but with regard to other crops which can be profitably cultivated under more sunny skies than we can reckon upon in our humid climate.* I may add that a careful

* An interesting, and in some respects instructive, little book on Tobacco has recently been published by Mr. Stanford; but the author (Mr. P. M. Taylor) describes the system pursued in the Department of the Lot et Garonne, which is even less applicable to a northern humid climate than that ordered by the Régie for the Gironde.

comparison of the regulations issued for the Departments of the "Nord" and the "Pas de Calais" shows that the dates fixed by the Government for some of the operations vary even in these adjoining districts.

Humidity alone is not a fatal drawback to the growth of tobacco; and mere growth, in the sense of size of the leaf, is but one element in the profitable production of manufactured tobacco, the essential qualities being combustibility, flavour, and colour, in the order in which I have named them. Latitude seems to have very little to do with the question, for north of Stockholm, years ago, I saw tobacco grown with great success, so far as one can judge from its appearance in the field. What the plant requires, as I shall show presently, appears to be about three months of favourable growing weather, from the date of planting out the seedlings to the date of harvesting the mature leaves. Hot mists do not injure the plant, nor do gentle rains, but a hailstorm is utterly destructive. Where high winds are likely to prevail, tobacco is either not grown, or the plantations are artificially sheltered, as on the Dutch system, which I shall describe in the course of this paper. At the same time, a certain amount of sunshine is necessary to enable the plant to develop in its leaves the requisite but not superabundant amount of the essential oil which is its characteristic, and which gives it the distinctive value pertaining to it.

The object of the experiments on the cultivation of tobacco which are now in progress, is to ascertain whether it holds out any reasonable hope for even a partial diminution of the prevailing agricultural depression, and a means of employing the surplus agricultural population without too great a cost to farmers and landowners. The movement is therefore partly commercial, and partly philanthropic. It may, however, be useful to trace, as far as the data at my command will permit me, the progress, whether forward or retrograde, of tobacco-cultivation in Holland, Belgium, and the North of France, within recent years. Unfortunately it is impossible to give parallel statistics for each country, so that the separate statements must be considered individually, and each one on its own merits.

In the Netherlands, the average extent of land planted with tobacco in the years 1851–60 was 1760 hectares; in 1861–70 it was 1711; in 1871–80 it fell to 1676 hectares on the average of the ten years, the middle of that decade having been the commencement of the still prevailing agricultural depression. The average for the years 1881–82 was only 1298 hectares, for 1883 the slightly diminished area of 1248 hectares, and for 1884 a small excess, raising it to 1272 hectares.

In Belgium the Agricultural Statistics are taken only at long and somewhat uncertain intervals. The last census was taken in 1880, and the previous one in 1866, in which year there were 1694 hectares of land returned as planted with tobacco, while at the more recent census the returns showed only 1576 hectares under that crop.

In France, the cultivation of the tobacco-plant is entirely under the control of that department of the State which is known as the Régie. Farmers who wish to grow tobacco send in their applications, and, subject to certain reservations as to minimum size of plots, they are allowed to do so under the supervision of the officers of the Régie, known as "Controllers of cultivation." The Régie fixes the total of its requirements, and the prices which the State will pay for the cured tobacco, according to quality, one year in advance; and then allots the total amongst the several departments, partly according to the applications sent in, and partly according to the known suitability of each department to produce the quality of tobacco required. As already mentioned, it is unnecessary in this paper to consider more than two of the tobacco-growing districts of France, namely, the "Nord" and the "Pas de Calais." The following Tables (pp. 735 and 736) for the ten years 1863–72, will be found very instructive, as illustrating the French system and its results. It will be seen that while in the "Pas de Calais" the cultivation of tobacco was practically stationary as regards the number of growers, and only slightly diminishing as regards the area of land planted, yet in the "Département du Nord" the ten years showed a continual decrease both in the number of cultivators and in the acreage of land planted. The official explanation of this fact is, that "La diminution de la culture dans ce département tient au développement exceptionnel qu'y ont pris les cultures industrielles." Without wishing to lay too much stress upon what happened in the North of France between ten and twenty years ago, this statement, made on official authority, seems to show that other industrial crops were then, at least, more profitable to the farmer than tobacco. I shall endeavour to show what has taken place since the issue of the Parliamentary return from which the two annexed Tables are extracted.

If we pass over an interval of ten years we find that, as regards the Département du Nord, the quantity of tobacco demanded by the Government and that produced by the farmers had not appreciably altered, while the number of cultivators, the acreage of land planted, and the average price, were all within range of the figures for the previous years. In the "Pas de Calais," on the contrary, it will be seen that there was an important increase in the number of cultivators, the extent of

TABLE I.—STATISTICS relating to the GROWTH of TOBACCO in the DÉPARTEMENT DU NORD.

YEARS.	Number of Cultivators.	Number of hectares cultivated.	Quantity of Tobacco demanded.	Quantities paid for.	Amount paid.		Average price per 100 kilos.	
			kilos.	kilos.	francs.	centimes.	francs.	centimes.
1863	1,600	914	2,800,000	2,567,521	2,279,065	30	88	77
1864	1,544	918	2,800,000	1,984,176	1,645,157	80	82	91
1865	1,384	809	2,800,000	2,513,978	2,095,625	00	83	35
1866	1,310	770	2,800,000	2,110,441	1,701,119	90	80	60
1867	1,068	603	2,800,000	1,714,479	1,525,722	20	88	99
1868	1,014	564	2,800,000	1,460,177	1,301,780	40	89	15
1869	961	537	2,800,000	1,216,149	1,026,109	60	84	37
1870	896	473	2,500,000	1,256,397	1,053,360	40	83	83
1871	696	365	2,500,000	907,917	807,054	90	88	88
1872	852	424	2,500,000	1,146,164	1,035,811	30	90	37
Total	11,325	6,377	27,100,000	16,877,429	14,470,806	80		
Average	1132·5	637·7	2,710,000	1,687,742 9	1,447,080	68	85	74
1882	726	466	2,520,000	1,315,240	1,158,146	60	88	05

TABLE II.—STATISTICS relating to the GROWTH of TOBACCO in the DÉPARTEMENT DU PAS DE CALAIS.

Years.	Number of Cultivators.	Number of hectares cultivated.	Quantity of Tobacco demanded.	Quantities paid for.	Amount paid.		Average price per 100 kilos.	
			kilos.	kilos.	francs.	centimes.	francs.	centimes.
1863	2,690	574	1,800,000	1,145,255	950,745	20	83	01
1864	2,793	610	1,500,000	896,371	719,211	50	80	23
1865	2,666	569	1,200,000	1,221,878	998,867	70	81	74
1866	2,758	601	1,200,000	1,015,576	701,343	20	69	05
1867	2,560	537	1,200,000	921,702	711,617	00	80	20
1868	2,368	505	1,200,000	1,053,754	882,394	80	83	73
1869	2,248	492	1,200,000	861,166	656,994	80	76	02
1870	2,247	478	1,200,000	946,523	757,896	00	80	07
1871	2,233	460	1,200,000	853,251	666,947	10	78	16
1872	2,399	505	1,300,000	1,071,696	894,510	30	83	46
Total	24,962	5,331	13,000,000	9,993,175	7,970,527	60		
Average	2,496·2	533·1	1,300,000	999,317·5	797,052	76	79	75
1882	3,598	824	1,800,000	1,340,785	1,216,999	44	90	76

land planted, the quantity of tobacco demanded and delivered, and of course the sum paid for the crop. It is also very satisfactory to find that these larger figures, which are due to an extension of cultivation, are accompanied by a higher average price, which is of course due to a better quality of the crop, and is doubtless the result of greater skill and knowledge applied to its management. Two other facts which are made manifest by the Tables should not be lost sight of:—Firstly, that in neither department does the quantity of tobacco produced reach the total allotted to it by the Government; and secondly, that in the "Pas de Calais," the average area of land planted with tobacco by each cultivator does not much exceed half an acre, while in the "Nord," the proportion to each cultivator is nearly three times as much. It therefore appears that small plots of tobacco, which can be managed by the small farmer's or labourer's wife and children, are deemed the most profitable; and that on a large scale either the price fixed by the Government is insufficient, or the difficulties of cultivation and management are too great in practice. Speaking from my own experience, I may say that I have generally found the quantity of land devoted to tobacco in each of these Departments to be what is locally called a "measure," which is seven-eighths of an acre; but in the "Nord" there are many farms upon which a much larger acreage is grown, while in both Departments there are others where the cultivation of tobacco is on a smaller scale.

It is not desirable to discuss matters of law or policy in the pages of this 'Journal,' therefore it will be sufficient to state that the conditions under which tobacco has been allowed to be grown in the countries which I have mentioned have varied from time to time, but in general terms the cultivators have been registered, and their proceedings have been subject to the supervision and control of the Government officers appointed for that purpose. In France, the Government has a monopoly of the manufacture of tobacco, nominally for only a period of ten years from each enactment, but practically in perpetuity—until at least the state of the Budget allows, if it ever will allow, of private enterprise being devoted to this industry. At one time, the cultivation of tobacco was allowed only in certain departments in the north-east and the south-west of France, and these same departments are still the head-quarters of the cultivation of this plant.* But on the 12th of February, 1791, the National Assembly authorised the cultivation of tobacco in any

* This statement I should vary, inasmuch as the "Département du Bas Rhin" now forms part of the German Empire.

part of France; therefore the National Agricultural Society issued a pamphlet of 'Advice to Cultivators,' an abridged translation of which I think it proper to insert here because: (1) Comparatively little alteration has since been made in the methods of procedure so far as the growth of the plant is concerned; and (2) the pamphlet is in the French language, and is now exceedingly difficult to procure.

*Advice to Cultivators on the Growth of Tobacco in France.**

A decree of the National Assembly of the 12th of February, sanctioned by the King, renders free the cultivation of tobacco throughout France. Although this plant is not one of those necessary to the life of man, nor very important on account of its consumption in various countries, yet the number of people in France for whom it has become a necessity is so considerable, that the means of increasing and bringing to perfection its culture should not be neglected. Therefore the Agricultural Society has gladly taken the very first opportunity of enabling all the agriculturists of the kingdom to benefit by this decree, by showing to those who do not already know, how to propagate and prepare the tobacco plant.

The details in which we are about to enter have been taken from information received from several members and correspondents of the Society.

The tobacco plant, like many others, is sown first of all in a nursery or seed-bed, and transplanted when strong enough. The nursery should be a hot-bed in the districts where the spring is cold, and simply a strip of garden land in regions where the beginning of that season is mild.

Cultivators should consult gardeners on the method of making the seed-bed and on the degree of heat which it should possess when the seed is sown. Fresh horse-dung is generally used; but in default of that, cow-manure is employed, although it is not as good. To plant an "arpent" (about $1\frac{1}{4}$ acre) of land, $\frac{3}{4}$ of an ounce of tobacco-seed is required, which should have a seed-bed 22 feet by 4. The soil must be from $1\frac{1}{2}$ to 2 feet thick. The manure being well pressed, it is covered with 6 inches of earth composed of garden and leaf mould, or of garden soil only. The bed is surrounded with boards to support it and prop up the frame, if in a country where the latter is necessary.

Two-year-old seed will germinate as well as that of one year, but an older seed cannot be relied on. In case of doubt, a few seeds can be sown as an experiment in a frame, or under a bell glass, or in a seed-bed. The sprouting of a few seeds may be hastened by placing them in a piece of linen, moistened from time to time and kept in a warm place. When the sprouts are from $\frac{1}{4}$ to $\frac{1}{2}$ an inch long, the seed may be sown, and very soon comes up.

The time for sowing tobacco in France is from the end of February to the end of March. This plant being very sensitive to frost when young, as also when approaching maturity, must be preserved from the frosts of spring, and must also be sown early enough to become ripe before the hoar frosts of autumn. A fine day should be chosen to sow the tobacco seed. The seed being very small, either sand or earth is sometimes mixed with it to insure its being more equally distributed. As soon as sown, it should be watered with a very fine rose and covered with a very thin layer of finely sifted earth, so as just to cover the seed.

A necessary precaution is to cover this seed-bed with some light straw, either newly threshed, or taken from the manure of an old seed-bed. The result of this covering is that the earth is not disturbed nor the seed washed

* Published by the Royal Agricultural Society of Paris, 1791.

away by watering, therefore it comes up more equally than it otherwise would. If sown early in a cold climate, it should be covered at nights either by boards supported underneath, or by bell glasses, by branches, or by long manure. There are also tobacco growers who use frames covered with squares of glass or oiled paper. Finally, in order to force the sprouting of the seed, some people close the bed for three or four days, using a frame and covering the joints with cow-dung; after this they air the bed, water it, and shut it less carefully. We do not recommend this method, because those who do not know how to employ it properly scorch the seed and the young plants, or make them come up too quickly and prevent them gaining strength. It is not necessary to cover up the seed-bed if one knows how to take advantage of the heat which it contains. This can also be made greater by adding manure round it, if the atmosphere remains too cold.

Care should be taken to keep the young plants weeded, and also watered when necessary.

The precautions which we indicate for the seed-beds apply equally to ordinary strips of land which are used where special seed-beds are unnecessary.

The plants of the seed sown in February can be transplanted in May, but those from seed sown in March must be transplanted later in the year. If transplanted too young or too old, it will be equally troublesome to make them take root.

When they have developed five or six leaves, the weather being favourable, they are sure to do well. They should not be planted out until there is no further fear of frost, because they cannot be protected in an open field. In Paris it very rarely freezes after May 10th. The land on which tobacco should be planted requires preparations which we shall now describe.

Tobacco should be first grown in small quantities on all sorts of land, in order to see which gives the greatest quantity and the best quality. The obstacles which, until now, have been placed in the way of cultivating this crop, have prevented us obtaining enough experience to give advice on this point. But if any one wishes after this year to plant a large quantity of tobacco, we should feel obliged to tell him beforehand that, according to all the information we have received, tobacco succeeds best on a "substantial" soil. By this word we mean a soil composed of sand and vegetable matter, or of light land well mixed with clay. It must be deep and well mellowed. Cleared woodland, broken up grass-land, and newly-reclaimed land are the best for tobacco, as they may be regarded as new land.

According as the land destined for tobacco-growing is more or less compact, it should be more or less worked. If the plough is used, one furrow should be turned before winter, so that the frost can pulverise the clods; and the land should be worked twice after winter, namely, once at the begining of spring and once a little while before the transplantation of the tobacco. Certain land must be worked four times, once before winter and three times after, and it must be harrowed after each time. Preparing the land with the spade or the fork is preferable to ploughing, but is more expensive. It is then sufficient to give one digging before winter and one at spring time, unless the ground is very foul, in which case it requires a third stirring.

Manure must never be put on newly broken-up land, but only on that which is regularly cultivated, and which has produced wheat or some other crop which has exhausted it. As the tobacco-lands are generally strong, the manure of horses, sheep, and poultry, with dried night-soil, are generally preferred. It is needless to tell cultivators in general, that if they use strong land they should also use fresh manure as well as marl, chalk, or lime, to lighten it; and when the land is too light, it should be made stronger by using ripe manure, especially cow-manure, chalk, and clay. These preparations of the land are as necessary for tobacco as for maize and wheat.

The quantity of manure indispensable for the crop depends upon its kind and condition, as well as upon the nature of the soil. It is sufficient to say that the land for tobacco should be manured the same as for wheat.

When the work is done by hand, small mounds should be raised, the bases of which should be between 2 and 3 feet in diameter. In the last working by the plough large ridges should be raised similar to those made when a vineyard is to be planted. These take the place of the mounds.

When the land has been thus prepared and the seedlings have reached the proper height and strength, the next step is to plant them. This should be done after rain, as it is necessary to have every facility for taking up the plants with all their roots and rootlets, together with a small portion of earth, and then to place them in soil which will not dry them up. In the case of dry weather, the seed-bed or nursery must be well watered as well as each plant when pricked out. Care should be taken not to water too much at once, as it is better to water twice.

Planting out is done in the ordinary way by means of an ordinary planting stick; the plant is then buried up to the first eye, that is to say, up to where the leaves begin to sprout. Then, with the aid of the dibble, the earth must be pressed tightly round the roots. When the mound system is adopted, a plant is placed in the middle of each mound; when the land is in ridges and furrows, the plants are placed about 2 feet apart, so that they form a quincunx: the poorer the land the farther the plants must be put apart. Sometimes a late frost kills the young seedlings, in which case they should be replaced by those kept in reserve in the seed-bed.

The tobacco field should always be kept free from weeds, weeding being done as often as is necessary; it should at least have three weedings, the times depending on the state of the field.

When the plants have attained the height of about 1 or 1½ foot, which they do about six weeks after plantation, they are ridged up like maize and potatoes; this operation can be performed with a hoe, a narrow spade, or any other appropriate implement. When the plants begin to show blossom-buds, these must be picked off with the fingers, as well as the growing point, so that there remain only twelve or fourteen leaves. The plant is then reduced to the height of about 2 feet. Small shoots soon grow out from the axils of the leaves and should be pinched off as soon as they appear, so that the sap may be entirely concentrated in the leaves; this last is the chief object of the cultivation.

To obtain seed, a few plants in the field are left untouched. Very few must be left if the seed is not for sale, as one good plant yields enough seeds to sow an "arpent" (about 1¼ acre). The most vigorous and the oldest plants of the first plantation should be reserved for seed, and not those which have replaced others. In Holland, all the leaves of the seed-plants are picked off as they grow, so that all the sap may rise to the seed. The seed-plants are not gathered until the seed-cases become black. They are then cut and hung to the roof of a shed or room until spring. The seed improves in quality and keeps well in the capsules. As for the plants which have been nipped in order to furnish the true tobacco, the leaves are ready when they begin to lose the vivid green which characterises them, and acquire a slightly yellow colour. They then droop, diffuse their perfume to some distance, and become covered with small spots, while their margins break very easily in the fingers.

The leaves do not all ripen at the same time, therefore they cannot all be gathered together, but the bottom leaves are gathered first and then gradually the upper ones. For this reason, in some districts, there are three distinct qualities, the best consisting of the top leaves. In the best establishments each quality is kept apart from the other.

As the leaves are gathered they are placed one on top of the other as neatly as possible, and then carried to the drying shed.

The leaves are threaded with twine, or thick thread, and suspended on rods, or else they are pierced and threaded on alder or willow poles from 5 to 6 feet long and an inch thick. The leaves are so placed that the ribs of one do not touch those of the other. The poles rest on pieces of wood and are placed under each other in a dry shed or barn, with openings all round, so that the wind can dry the leaves, which are also shaken from time to time, especially when it is not windy. The greater the distance between the poles, and the farther apart the leaves, the easier they are dried. The higher or first quality leaves, being thicker and more fleshy than the others, require longer to dry. The leaves are always picked as close as possible to the stem, so as to waste nothing.

If the weather is cloudy or damp, a fire must be made in the drying shed to prevent the leaves rotting, but in dry weather one must be careful as to the employment of artificial heat.

Practice teaches best when the leaves are sufficiently dry. If too dry, they lose their perfume; if too damp, they rot. The best way of telling is when a handful of the leaves are pressed in the hand they regain their proper shape without being broken immediately they are released.

When the leaves are dry enough, the poles are taken down and laid on the ground, the leaves still remaining on them. They are placed one on top of the other in the form of a square, an empty space being left in the middle so that the vapour which comes from the leaves may find an outlet; they are left in this state for a week or a fortnight, after which they are covered up until they are tied into bundles, which is done by means of a large wheel placed in front of the table on which the tobacco is gathered. These bundles are placed in matting, hampers, or casks containing 12, 13, 14 or 1500 lbs. each.

The stems remaining after all the leaves are gathered are used to manure the land by being ploughed or dug in.

These general directions may be taken as a very reliable guide to the cultivation of the tobacco-plant even at this day; but subject always to variations in practice caused by differences of soil and climate, as well as our better knowledge of the properties of manures, and their influence upon the quality and the combustibility of the manufactured article. Originally, it appears that tobacco was grown in the north-west of Europe solely for the purpose of being made into snuff, then an advance was made in the direction of producing smoking tobacco for pipes, and finally the highest rank was attained, namely, the manufacture of cigars.

At present there are, I believe, twenty-two Departments of France in which tobacco is allowed to be grown. In the Netherlands and Belgium, any person may grow as much tobacco as he likes. The duty in the latter country was last fixed during the Session of 1882–83 as follows:—All home-grown tobacco is liable to a duty of 24*s*. per 1000 plants; but in those cantons where the average produce is estimated not to exceed 6 kilogrammes (about 13 lbs.) of dry tobacco per 100 plants, the duty is reduced to 20*s*. per 1000 plants; and it is still

further reduced to 16*s.* per 1000 plants in those cantons where the average yield is estimated not to exceed 5 kilogrammes (11 lbs.) of dry tobacco per 100 plants.

Tobacco may be grown on almost any soil, but the results are never satisfactory on a stiff clay or a poor sand. Going to the extreme of suitability, it is generally considered that a rich loam or marl is the most favourable for this, as for most other cultivated plants. A large quantity of decayed vegetable matter in a soil renders it specially suitable for the cultivation of tobacco, which delights in the presence of slowly decomposing manurial substances. This vegetable matter furnishes the necessary organic acids to unite with the potash applied as a manure, and thus gives the product the quality necessary for the purpose of enabling it to be manufactured into cigars. In America, newly cleared and charred forest-lands are preferred for the production of the finest quality of tobacco; but this condition can rarely be obtained in a densely populated and highly cultivated country like England. Next in importance to the quality of the soil are its situation and its hygrometric properties. Tobacco cannot flourish if exposed to high winds or to moisture at the roots. It is quite as sensitive to these influences as we are to draughts and wet feet. For these reasons the Dutch, who cultivate tobacco under most disadvantageous circumstances, plant out the seedlings on high ridges, and divide the land into small squares by live fences, as I shall describe hereafter. It may, indeed, be accepted as a general rule that tobacco cannot be successfully cultivated in the north-west of Europe unless, either by natural or artificial means, the old political cry be varied to "Shelter," "Shelter," "Shelter," and as such put into practice. If the shelter be natural, so much the better; but if natural shelter does not exist, it must be provided artificially.

It therefore appears that while tobacco leaves the grower a wide choice of soil, it is very exacting as to situation and climate. All conditions may, however, be modified more or less by artificial means; but with tobacco, as with many other agricultural and industrial plants, there are certain unknown, or at least undefined, circumstances which so greatly influence the quality of the product, that they alone determine the suitability of its cultivation for profit. In illustration of this point, I may again quote the adjoining French Departments of the "Nord" and the "Pas de Calais." I was everywhere told that the tobacco grown in the former Department was only fit for snuff, while that grown in the latter was good enough for cigars! Here one has the Alpha and Omega, and the only explanation I could find was that the soil in the "Pas de Calais" is much lighter than that in the "Nord," except in

one arrondissement, where the tobacco has the same quality as across the administrative boundary.

As to the rotations of crops, they vary very much with the nature of the soil, and also with the climate. In Belgium and the heavy-land districts of the North of France, as well as in Germany, an interval of at least three years between tobacco-crops is considered necessary, and wheat never forms part of the rotation, because in consequence of the land being so highly charged with manure, the wheat plant becomes too proud, makes a large quantity of flag, and does not blossom well. The Belgian system is to grow barley, rye, and oats or maize, in the interval; but clover is avoided, on account of the danger of wire-worm. In the Palatinate, two succeeding crops of spelt, or one of spelt followed by beetroots or potatoes, are the immediate precursors of the tobacco-plant. In the Netherlands, and in the light-land districts of the "Pas de Calais," tobacco is taken continuously on the same land—a practice which is said to improve the quality, but to diminish the weight of the crop.

The preparation of the land and of the seed-bed has been already described in the Instructions issued by the French Society, but I may add that, while the system of protecting the seedlings with frames covered with oiled paper prevails in the Netherlands, it is generally regarded as sufficient protection in France and Belgium if straw be placed over them at night. This again is a matter of climate.

The manuring of the land for tobacco is of the greatest importance, and many experiments have been made with a view to ascertain the effect of different manures and of different manurial constituents upon the bulk, the colour, the flavour, and especially the combustibility of the leaf. In Belgium, where quantity is chiefly aimed at, composts and oilcakes are placed in the front rank of manures, and are followed in order of merit by street-sweepings, fæcal matters, guano, fish-manure, pig and sheep-manure, and, last of all, farmyard-manure. In some districts of France, the use of forcing manures is prohibited; however, the following examples may be deemed illustrative. One large grower (10 to 15 acres) in the Department of the "Nord," whom I visited this autumn, applies 20 tons of farmyard-manure per acre in the winter months, and 4 tons of rape and other cakes in the following March. In this case, notwithstanding the heavy dressing of manure, the tobacco was only fit for snuff, because, I presume, the soil is too heavy to enable it to produce a finer article. Another illustration from the Northern Department of France may be given to show how the residue of beetroot distilleries is utilised on a large scale as a manure. On a farm not far from the one previously mentioned,

the land is turned up in ridges about 12 inches high and 20 inches from crest to crest; as soon as the first frosts appear, the liquid refuse of the distillery is turned into the furrows; in the spring the ridges are split and the tobacco planted in the usual manner. If the supply of distillery refuse falls short, it is supplemented by oilcakes to the extent thought necessary. In this case the land was cultivated upon a three-course shift of (1) Tobacco, (2) Beetroots, (3) Wheat; and the crop of beetroots regulated the quantity of distillery refuse available. But almost wherever tobacco is grown, from the Netherlands to the United States, great faith is placed in the value of sheep-dung. On this point I may quote American opinion, as expressed in the recently published 'Statistics of Agriculture' for 1880 (p. 244, of the chapter on "Tobacco Production in the United States"):—

"The cause for feeding so many sheep for their mutton in this valley (Connecticut) is the high value of sheep-manure for tobacco-growing, it having the effect on our light soil to produce a dark-coloured silky leaf, of good burning quality, suitable for wrapping fine cigars. This tobacco burns white, and has a good sweet flavour, perhaps owing to the potash it derives from the manure. So valuable do we consider this sheep-manure, that we have shipped, since 1870, from West Albany, from 50 to 60 cords,* costing from $8 to $10 a cord, every spring. On our light soils, called pine lands, after raising crops of tobacco, 2000 lbs. to the acre, we have sown wheat, yielding 30 bushels, plump berry and heavy weight of straw, on land which, without this dressing of manure, is fit only for white beans. We of late years feed with our sweetest and finest hay, and mix with our corn one-third cotton-seed meal. By so feeding, our sheep fatten more easily, being more hardy and better conditioned, beside increasing the value of the manure and rendering more full of plant food."

Against this statement, however, I should mention that in some northern light-land districts, such as portions of the "Pas de Calais," the use of sheep-dung is believed to give too dark a colour to the tobacco-leaf, and thus seriously to depreciate its value. On this account the use of rape-cakes as manure is much preferred.

With regard to the prevailing opinions in New England on the influence of other manures on the tobacco-crop, the reporter for New England remarks as follows:—

"There is a considerable contrariety of views expressed respecting the effects produced upon the quality of the tobacco by the application of the several fertilizers. In some of the schedules returned to this office from intelligent growers, it is strongly stated that heavy manuring is not only necessary to grow heavy crops, but that in the heaviest crops is found the largest proportion of excellent leaf. Others claim that heavy fertilization, while it adds unquestionably to the quantity produced, yet affects the quality injuriously as to texture, strength, and silkiness. These contradictory state-

* A cord weighs about 2 tons.

ments can only be reconciled by the hypothesis that the soils in either case are radically different in chemical constitution. Says one schedule: 'Fish-guano makes tobacco heavy, rough, and scaly, with bad burning qualities.' Others claim that fish-scrap is an excellent manure. The first statement accords fully with that made by Professor Johnson as to the widespread prejudice existing among tobacco-growers to the use of fish or fish-guano on tobacco-fields. Of the beneficial effects of Peruvian guano on tobacco soils there is no discordance of views.

"In the Housatonic Valley the land, whether sod or cultivated in a previous crop of tobacco, is treated to a heavy application of stable manure, running as high as thirty or forty cart-loads to the acre, at a cost of from $50 to $60. Cow-dung is said to have the best effect upon colour, horse-dung, though making a good quality of tobacco, inducing lighter colours. Saltpetre also is applied to improve the quality. All fertilizers, except special manures, are spread broadcast over the land, and are ploughed or harrowed in; and without their use it would be considered folly to plant a crop of tobacco, as the small size of the leaf, and the deficiency in gum and other qualities, would make the crop exceedingly unprofitable."

To discover the *rationale* of the manuring of land for tobacco, was one of the objects of numerous experiments made by M. Schloesing in the years 1861–65. M. Grandeau published an abstract of M. Schloesing's reports in 1868, and from that little work it appears that the chief conclusion arrived at under this head may be stated as follows *:—Tobacco often needs a very strong manuring, in order to acquire one of its essential qualities, viz., combustibility; if it follows in the rotation either beetroots, peas, clover, or any crop which requires much potash, a sufficient quantity of that material will not be left in the soil to render it combustible. Therefore it is not nitrogen, as is generally believed, that is necessary in the manure, but potash. Finally, M. Schloesing believes that he is authorised, as the result of his experiments, to state simply that tobacco absorbs much more nitrogen from the air than has hitherto been allowed, and therefore does not require, for its successful cultivation, a heavy nitrogenous manuring of the soil. As a matter of ordinary farm-practice, I have myself found that potash is largely used to increase the "combustibility" of tobacco grown on land which will produce a leaf fit for smoking purposes, but not on land suited only for snuff-tobacco.

In the years 1878–80 further experiments as to the influence of potash upon the tobacco-plant were made by M. Blot,† with a view to check the results at which M. Schloesing had arrived nearly 20 years previously. He came to the conclusion that

* 'Le Tabac, sa culture,' &c., par Th. Schloesing, précédé d'une introduction par L. Grandeau. Paris, Maison Rustique, 26 Rue Jacob. Unfortunately, this work is out of print, and I am indebted to the publishers for lending me their single remaining copy.

† 'Mémorial des Manufactures de l'État.' Tabacs, livr. I. December 1884, pp. 5, *et seq.*

there is a maximum quantity of potash united with organic acids in the tobacco-plant towards the 75th day of its germination,* and at the period when the superficial development of the lower leaves ceases. Also that there is an uninterrupted increase in the quantity of nicotine, from the germination of the seedling to the maturity of the disbudded plant. Further, that atmospheric conditions have a manifest influence upon the proportions of potash and nicotine, humidity hastening the assimilation of potash and retarding the elaboration of nicotine, while heat favours the latter operation.

A variety of considerations of much practical and theoretical interest are suggested by the experiments of these two eminent men, and have been fully discussed by them. In the present experimental condition of tobacco-growing in England, it is only necessary to mention the following:—

(1.) That the influence of potash is specially physical, not adding to the weight of the crop, nor having any appreciable effect upon the percentage of nicotine which it contains, but giving to the leaves fineness and suppleness.

(2.) That therefore the best cigars are made when the leaves are gathered before maturity, and when they contain the greatest quantity of potash.

The great question for the grower is, whether it would pay him better to harvest his tobacco early for the sake of extra quality, or to allow it to become more ripe for the sake of extra quantity. I have no data bearing upon this question, except the results of two experiments made by M. Blot himself in France, where the prices are fixed a year in advance by a Government department, and where, therefore, competition finds no place.

M. Blot's first experiment was made in the Department of the Gironde in 1873, where the experimental plot of plants, gathered before ripeness, gave a crop at the rate of 1380 kilos per hectare, and a gross return of 1010 fr., at the price of 73 fr. 18 c. per 100 kilos, fixed by the Régie. A similar plot of tobacco, gathered when fully ripe, yielded at the rate of 1640 kilos, and a money return of 1160 fr., at the Régie price of 70 fr. 73 c. per 100 kilos. Therefore the production of the finer quality in this case entailed a loss upon the grower of 150 fr. per hectare, or 48*s.* per acre.

The second experiment was made in 1881, in the Department "du Nord," with the variety of tobacco known as "Pas de Calais." The produce of the immature plants was at the high

* In our climate the number of days would probably be different.

rate of 2700 kilos per hectare, and was worth 2850 fr. at the State fixed price of 105 fr. 55 c. per 100 kilos. The ripened plants came to as much as 3100 kilos per hectare, and at the then fixed price of 100 fr. per 100 kilos for such tobacco gave a gross return of 3100 fr. per hectare. Here, then, the fine quality of tobacco yielded a smaller return to the grower than the coarser and riper crop to the extent of 250 fr. per hectare, or 4*l.* per acre.

As I have before indicated, I possess no means of ascertaining what the results might have been under a system of free cultivation, free sale, free purchase, and free manufacture. One remark may, however, be permitted, namely, that although the distinctive quality of tobacco exists in the secretion of its essential oil—nicotine, yet the efforts of the grower seem to be devoted to the diminution of its percentage in the leaves, and the increase of their combustibility; while the curer, as will be seen presently, devotes his attention to the production of a comparatively light colour.

As stated by the French Agricultural Society, the land must be first ploughed immediately after the preceding crop has been harvested, namely, as early in the autumn as possible, and a heavy dressing of cow-manure is then turned under. According to the strength of the land, two or three ploughings and harrowings are given in the spring, the last act of cultivation being accompanied by a heavy dressing of sheep-dung, rape-, or other oil-cake, guano, or some artificial manure rich in potash. Generally speaking, the land is set up in ridges and furrows, and the seedlings are transplanted at various intervals according to the nature of the variety of tobacco cultivated and the quality of leaf desired. The ridges are from 16 to 24 inches apart, and the plants from 14 inches upwards distant in the rows. Some growers prefer to plant the seedlings in separate hills from 2½ to 3 feet apart, and this plan has been adopted by Messrs. Carter on their experimental acre near Bromley, the land having been dressed in the autumn with 30 tons of farmyard manure, and in the spring with 7 cwt. of a special artificial manure containing a large percentage of potash.

In the Netherlands, the land is divided into squares of about one-tenth of an acre by means of live fences consisting generally of haricot runner beans. By this means the force of the wind is broken and the warmth of the atmosphere is retained in the enclosures. Mr. de Laune has adopted this plan in his experiment this year, the only difference being that hops are substituted for haricot beans in his case, and the effect upon the temperature in raising that inside the enclosures was very noticeable on the day when I visited the experimental field last August. In

the North of France, maize is not unfrequently grown round the tobacco plots as live fences for the same purpose.

The date of planting out the seedlings must be regulated by the climate of the locality. There is but one rule to follow, namely, to defer planting until after all danger of spring frosts has passed. In the vicinity of Paris, May 10th is said (see p. 739) to be the important date; in the South of England, May 22nd has frequently been mentioned, but for a delicate sub-tropical plant like tobacco, probably June 1st would be much safer in England generally. It is, of course, very desirable to plant out as early as is practicable after the cessation of spring frosts, so as to be able to harvest before the arrival of the autumn frosts.

After the seedlings have been planted out, they require incessant care, chiefly in judicious watering at their roots, and continuous weeding and stirring the land, as well as earthing up, when the plants are sufficiently advanced. Then when the plants have developed the number of leaves agreed upon—from 8 to 12 or more, according to the quality of the tobacco required—the growing point must be pinched off, and the axillary shoots must be disbudded as fast as they appear. If the plant should develop a precocious maturity and show terminal flower-buds before the proper number of leaves have been formed, the leaves unformed must remain in that condition, and the flower-bud and terminal shoot in their entirety must be pinched off immediately. Except in France, it is usual to allow a certain small number of plants to flower and produce seed for future use. The strongest plants, most true to their kind, are selected for this purpose; these are staked and deprived of nearly all their leaves and all side-shoots, so as to concentrate the strength of the plant in the seed-capsules. About 10 plants will produce 1 lb. of seed, which will be sufficient to provide plants for a large acreage of land (see p. 740). The seed being so small, it should be mixed with sand to prevent its being distributed too thickly in the seed-beds. In France, only those growers of tobacco who are specially authorized are allowed to produce seed, the Government undertaking to supply the quantities and kinds necessary to enable all growers to fulfil their contracts. The leaves are generally considered fit to be gathered when their fleshy part begins to lose its brilliant green hue and to assume a blotchy yellow tinge between the veins. This alteration in colour is associated with a development of perfume which is very remarkable, and which must attract the attention of even the most unobservant agricultural labourer.

There are three methods of harvesting the crop: (1) By picking off the leaves as they become ripe, commencing with the lower ones, and gradually proceeding upwards; (2) By

waiting until nearly all the leaves are ripe and then carefully picking them off at one operation, leaving the stem still standing; and (3) By cutting the stem about 2 inches from the ground with the leaves still attached. It should be added that great care is required when the last method is adopted, in order to prevent injury to the leaves. The first method has already been sufficiently described (pp. 740 and 741); it is carried out very carefully in the Netherlands, and in France is done, like every other operation connected with the culture and curing of tobacco, under the direction of the Régie, which insists upon the leaves being *cut off* close to the stem. The second method is generally practised in America, and finds favour because it is maintained that the lower leaves, being retained on the stem until the general harvest, prevent the upper leaves from being contaminated with the soil, as they form a screen in the event of heavy rains driving particles of soil upwards. The third system is adopted in parts of Belgium and other districts of Europe where the tobacco-harvest coincides with the corn-harvest, and where, therefore, it is difficult to devote a large amount of labour exclusively to the former.

Whichever system of harvesting is adopted, one rule is common to all, namely, that the operation should not be attempted in brilliant sunshine, as the effect upon the leaves, after they have been severed from the source of vitality, would be too sudden. On a cloudy day, harvesting may be carried on without let or hindrance; but on a bright day it should be terminated before the sun's rays have acquired their full strength, or should not be commenced until the sun has lost most of its power, say, towards four o'clock in the afternoon in the month of September in our climate.

Coming to the details of harvesting and curing,* it may be observed that in France the picking of the leaves at three different times, facilitates their classification afterwards. Thus, supposing a plant has ten leaves, the first harvest would consist of the lower three or four, the second of the middle leaves, and the third of the uppermost. On a few specially selected farms in the Pas de Calais experiments are being made under the supervision of the officers of the Régie, to test the value of the leaves which grow from the two uppermost axillary buds, which of course are not pinched off from these experimental plants. These four additional leaves form a fourth and latest harvest, but the

---

* It was my intention to give a Glossary of terms and words, to assist those who might wish to study further the French system; but a comparison of the Regulations issued to growers in a few of the French Departments showed me that the words used to signify the same thing differed so much in the several Departments, that such an attempt on the part of a foreigner would be simply misleading to students.

quality of the tobacco which they yield has not yet been ascertained.

The leaves having been cut off close to the stem, or the plant cut off close to the ground, there are several systems adopted to ensure what I call the preliminary drying. In some cases they are left loose on the ground for a time, longer or shorter, according to the weather; in others, they are made at once into garlands, as will be presently described, and laid thus upon each other; while under the most approved system they are suspended in long garlands from the top of a pole, so as to form a huge bunch, which is covered when deemed necessary by a sheaf of straw as a cap. Under each system the object is to get rid gradually of the moisture contained in the leaf; and straw in some shape or another is generally used both to moderate the action of excessive heat and of too great moisture. When the leaves are deemed sufficiently deprived of their succulence, the next stage in the drying process is resorted to; and I will endeavour to describe briefly its variations as I have observed them in the north-west of Europe.

In the French Departments of the Nord and the Pas de Calais, nearly every farm upon which tobacco is grown has either an orchard or a special enclosure used for the second stage of the drying process; but the smallest growers are contented with a series of pegs under the overhanging eaves of their farm-houses and outbuildings, from which to hang their garlands of leaves. Under the old system, the drying enclosure on larger farms is fitted with a series of erections similar to "parallel bars," but much higher. These bars terminate in a shed sufficiently wide to receive at night the whole of the series of cross-bars which rest and travel upon the "parallel bars." The cross-bars carry a number of garlands of tobacco-leaves according to the length of the bars, care being taken that there is air-space between each leaf, as well as between each garland and its neighbour. The garlands are made by passing a needle and twine through the stalks of from twenty to twenty-five leaves, and thus stringing them loosely and at intervals together,—the length of a garland being from 4 to 5 feet. The garlands are suspended from the cross-bars either by means of a peg, or a hook, or a wooden V-shaped twig-joint at the end of the string; and each garland is furnished with one of these appliances at each end, so that its position may be reversed every day or two, and thus equalize the drying of the individual leaves. At night, the cross-bars are pushed backwards under the shed, and it requires a considerable amount of practical skill to know exactly to how much sunshine and sun-heat the leaves should be exposed, as well as to how much dew, and other atmospheric influences, so

as to obtain the requisite amount of dryness without brittleness, and the best colour possible without the development of mildew.

The more modern system of drying consists in suspending the garlands from iron wires instead of cross-bars; these lines of wire are parallel to each other, and are fitted with straw-thatch roofs in short lengths, so as to be easily removable. These roofs project over the garlands on both sides, and protect them from the dew, thus doing away with the necessity of a shed or hovel at the end of the drying ground. In case of rain, straw hurdles are placed at the sides of the garlands, and form a very efficient protection. These straw hurdles abound on every tobacco-growing farm, being used for shelter of all kinds, and even as a bed for the man who sleeps in the drying-ground as a protection from theft. In every other respect the drying process out of doors is the same as on the other system, but there are slight differences of detail on nearly every farm.

The Belgian system is essentially the same as the French, the principal differences being that the drying places are temporary straw-hurdle erections, and that the garlands are more generally hung in festoons, suspended at both ends, than vertically from one end. When the whole plants have been harvested as such, the leaves are not separated from the stem until after they have passed through the stage of yellow colour to that of brown, which in no case should be allowed to assume too dark a tint. In the district of Grammont, where this method of harvesting is in vogue, the first drying is, as already described, upon the soil itself during the heat of the day, being afterwards completed by the suspension of the entire plants in granaries. Economy in labour and saving of the cost of drying-poles and wires seem to be the chief reasons for this method of procedure.

In the Netherlands, the horticultural method of drying assumes its extreme development, because the leaves are not made into garlands at all. Each leaf has its midrib split to enable it to be strung on a pole or stick, which rests horizontally upon two vertical supports. These structures have somewhat the appearance of a number of towel-horses placed parallel to one another; they are small and easily moveable, as the tobacco is not allowed to remain so completely in the open air in Holland as in France and Belgium. As I have seen the curing process in the first-named country there is always a drying-shed with vertical louvre-like shutters, by means of which the access of the sun, wind, and moisture may easily be regulated.

The third stage in the curing process may now be described. Its chief object is to develop the colour of the leaves without setting up a precocious fermentation. Here again there are a variety of methods of procedure, partly adopted by reason of

old habit, and partly as the result of recent experiments. The most primitive method is to place the garlands in heaps in the attics of the small farmhouses, which are commonly known as granaries, and to cover each heap with a layer of straw. The next advance upon this method is to place the layers of straw and the layers of the garlands of tobacco in a kind of sandwich fashion; and the third and most approved system is to suspend the garlands of tobacco on wires, while carefully sheltering them on both sides with straw hurdles, such as I have already mentioned. Under the first system the heaps require incessant attention, because if fermentation sets in at this stage the quality of the tobacco becomes irretrievably ruined. The slightest rise in temperature therefore necessitates the reconstruction of the heap, by placing outside what were previously the inside garlands. Under both the other systems there is less danger from this cause, and especially so under the last-named or *vertical* system. The straw absorbs the moisture under the *horizontal* system of layers, but currents of air help to carry it off under the *vertical* system.

When this process has been carried sufficiently far, according to the judgment of the grower, he proceeds to the preparation of his crop for market. In Belgium and Holland—countries in which he may sell his tobacco as freely as any other farm-crop, there are no restrictions upon his method of procedure; but in France the regulations of the Régie must be rigorously complied with. In practice, however, there is very little difference in the systems employed, for in all cases the first operation is sorting the leaves into qualities, and the second putting the assorted leaves into bundles of equal quality. It is impossible to describe the process of sorting with a view to guide novices. All one can say is, that the qualities sought for are good colour, fine nerves, tough and thin textures of the leaves, with good perfume. As the tobacco-leaves ought by this time to have lost at least 60 per cent. out of their 88 per cent. of moisture, it is obvious that great care is required to achieve this result without setting up fermentation or developing mould while avoiding brittleness. It is to the interest of the farmer himself to classify his leaves to the best of his ability, because the merchant always takes off a far larger sum from the price which he would otherwise be willing to pay, than the cost to him of a subsequent re-classification.

The next step is putting the leaves in bundles, and here again we see how much climate modifies all practices concerning the growth and curing of tobacco. In the Gironde each bundle must contain only 25 leaves, namely, 24 stalk to stalk, and one more to be used as a binder or tie; and the principal part of the

drying must be done under cover, to prevent the sun's heat converting the tobacco-leaves into a mass of powder. Mr. Meadows Taylor mentions 20 leaves as the regulation number in the Department of the Lot et Garonne; but in the most northern Departments of France (Nord and Pas de Calais) it is 50; and in Belgium and Holland, where people can do as they like, the number rises to 75 and 80. The fact is, that in these northern climates, supposing that the tobacco retains its proper percentage of moisture after drying, there is less reason to fear fermentation during the winter than in the more southern climes, and therefore more leaves may be put together in one bundle without danger. After the bundles are made, they are kept in heaps in the granary and covered over with straw or sacks, sufficiently to enable them to retain their remaining moisture until it is time to deliver them to the Régie in France, or to sell the crop in the ordinary way of commerce in Belgium and the Netherlands. As another example of the differences which the French Government have found it necessary to impose upon the growers of tobacco, I may mention that while in the Department of the "Nord" each bundle must be composed of 50 leaves and must be delivered in masses of 50 bundles, in the adjoining Department of the "Pas de Calais," although the bundles still contain only 50 leaves, yet each mass must contain 100 bundles.

I have seen a heap of bundles of tobacco-leaves, two years old, in a Belgian barn, covered simply with old sacks; but in France, the Régie gives a fortnight's notice of its requirement for delivery to the Magazine of the district. Time has not yet permitted me to investigate what takes place after the tobacco leaves the farmer's hands, except in one case in the North of France. The delivery of the tobacco begins annually in January, and generally continues until March. Upon arrival, the bundles are examined by a Committee of experts, who fix the price to be paid to the grower according to the quality of his crop and the fidelity with which he has classified the leaves in the several bundles. Payment is made immediately, and afterwards the bundles are taken possession of by the authorities.

The next process is an official fermentation in large masses of from 10 to 12 tons, as follows:—The tobacco on delivery at the Magazine should contain only about 28 per cent. of moisture; the bundles are placed in a long series of double rows, leaf-tip to leaf-tip, to a height of about 7 feet and a depth of 15 to 20 feet, according to the length of the mass, until the required weight is obtained. Wooden tubes containing thermometers are placed at intervals in the mass, so that the temperature may be observed from time to time. The heat desired is from

100° to 115° F., but if it rises above 120°, the whole mass must be taken to pieces and rebuilt elsewhere, each bundle being separately shaken. This rebuilding generally has to be done once, and sometimes twice.

When the fermentation is finished the temperature declines to 70°, and the quantity of moisture in the leaves to about 20 or 21 per cent. After the conclusion of this operation the tobacco is fit to be put into bales, to await the demands of the Government manufactories. The method of proceeding is to line cubical frames of one-metre in each dimension with sacking, and to pack into them the tobacco as hard as possible by means of lever presses. The bales of tobacco thus made can be safely kept for some time, but as a rule the product of one year's crop is consumed the next.

The possible profit to the English farmer from the cultivation of tobacco can only be guessed at, and the statements on the subject derived from Continental sources are widely divergent. As an example I will contrast the account given in the English newspaper 'Agriculture' of April 14th (derived from a Belgian source), with the statement furnished by the Agricultural Society of East Flanders to the Belgian Superior Council of Agriculture, only premising that the latter account comprises the actual figures taken from the canton of Grammont, which is admittedly one of the best tobacco-growing districts in Belgium.

	'Agriculture,' April 14th, 1886.			Official Report, 1878.				
	fr.		£	fr.		£	s.	d.
Manures	1000	=	40	1536	=	61	8	9
Labour	1000	=	40	601	=	24	0	9
Tobacco-tax	800	=	32					
Rents, rates, and taxes	300	=	12	261	=	10	8	9
	3100	=	£124	2398	=	£95	18	3

It should be observed that the Government tax is not included in the Official Report, but I do not propose to vary in any respect either statement. I now come to the returns, which are reported on page 755.

According to the unofficial statement, which is in round numbers, the profit of a hectare of land in tobacco is 38*l.*, or rather over 15*l.* per acre, but according to the official statement, the profit is only 9*l.* 7*s.* 3*d.* per hectare, or about 3*l.* 15*s.* per acre. It is quite obvious that the former calculation is a mere theory, more especially with regard to the price obtained for the tobacco, which rarely amounts to more than two-thirds of the sum mentioned in the calculation quoted by 'Agriculture.'

	'Agriculture,' April 14th, 1886.				Official Report, 1878.				
	fr.		£		fr.		£	s.	d.
2100 kilos, 1st quality, at 1 fr. 50 c. per kilo ..	3150	=	126	28,000 kilos.	2632	=	105	5	6
900 kilos, 2nd and 3rd qualities, at 1 fr. the kilo	900*	=	36						
	4050	=	162						

M. Letixerant, Chief Inspector and Engineer of the French Tobacco Department, gives the following account † of the expenses of a hectare of land planted with tobacco at Nijkerk in the Netherlands :—

	florins.		francs.		£	s.	d.
Manures	400	=	840	=	33	12	0
Labour	250	=	525	=	21	0	0
Seed and plants	30	=	63	=	2	10	5
	680	=	1428	=	£57	2	5

These items are irrespective of any charge for rent of land, or of buildings, or for Excise or interest upon capital employed. The same authority gives the gross proceeds as 900 florins, giving a nominal balance of 220 florins, or about 18*l.* 10*s.* per hectare, or 7*l.* 8*s.* per acre to cover all the other outgcings. As M. Letixerant observes, considering the rent value of the land and the necessary buildings, and the fair interest upon the capital employed, and the Excise, the only way in which profit can be obtained by the cultivation of tobacco is by the grower and his family doing the work themselves.

Many other statements of account might be given, but without definite information as to the district and the rate of wages which prevail there, such calculations are misleading instead of being instructive. For instance, in a Belgian standard work on tobacco ‡ a calculation for the French department "du Nord" is given showing a profit of only 103 fr. 55 c. per hectare, or about 32*s.* per acre, and another calculation from an unmentioned department of France showing a net profit of 1299 fr. 60 c. per hectare, or nearly 21*l.* per acre. These calculations are mere theories, and I can only repeat that the single exception

* In the original this amount figures as 1350 francs, or 900 kilos at 1 fr. 50 c., being the same price as for the first quality, although it is stated to be at 1 fr. the kilo. This mistake vitiates the conclusions drawn from the calculation in the newspaper referred to.

† 'Mémorial des Manufactures de l'État.' Tabacs. Tome premier. Deuxième livraison, p. 132.

‡ V. Demoor: 'Du Tabac.' Paris: Auguste Goin.

to which I can refer is the official statement to the Belgian Superior Council of Agriculture which I have already quoted.

I quite agree with the conclusion arrived at by M. Demoor, after considering his array of Profit and Loss Accounts, that if tobacco does yield a considerable return in good years, on the other hand we must not forget that in unfavourable and stormy years the crop is worth very little. In illustration of this I may state that this autumn I visited a farmer in the North of France, whose crop of tobacco had been rendered practically worthless by a hailstorm, which occurred in the third week of August; but the Régie insisted upon the crop being cured and delivered, although at the time of my visit it consisted of little more than the ribs of the leaves. Fortunately my friend's crops had been insured against hailstorms. On the whole, however, this year has been very favourable to growers of tobacco, in the districts which I have visited; but last year was precisely the reverse.

One final word of encouragement to English growers may be gathered from the experiments of M. Blot, the results of which I have already indicated. It is well known that a September hoar frost is absolutely fatal to the tobacco crop. The great expenses of labour, manure, rent, rates, taxes, duty, &c., incurred for the purpose of a tobacco crop, may be absolutely lost in consequence of a frosty night at the time when the tobacco is becoming fit to be harvested. But M. Blot tells us that the best tobacco is that which is harvested before it comes to maturity. If this should prove to be the case in our climate, there is more chance of tobacco being successfully grown in England than I ever anticipated, although, as I have tried to make it clear, the profit to the grower under this system is not so great, even on the Continent as upon the old plan of harvesting the tobacco as it arrives at maturity. M. Blot's experiments have only recently been published, and his conclusions are eminently worthy of being put to the test by English pioneers in this new effort to grow tobacco in the United Kingdom.

Royal Agricultural Society of England.

1886.

President.

LORD EGERTON (OF TATTON).

Trustees.

Year when Elected.	
1879	H.R.H. THE PRINCE OF WALES, K.G., *Marlborough House, Pall Mall,* S.W.
1855	ACLAND, Sir THOMAS DYKE, Bart., M.P., *Killerton, Exeter, Devonshire.*
1857	BRIDPORT, General Viscount, K.C.B., *Cricket St. Thomas, Chard, Somersetshire.*
1861	DENT, J. D., *Ribston Hall, Wetherby, Yorkshire.*
1871	EGERTON (of Tatton) Lord, *Tatton Park, Knutsford, Cheshire.*
1863	KINGSCOTE, Col., C.B., *Kingscote, Wotton-under-Edge, Gloucestershire.*
1868	LICHFIELD, Earl of, *Shugborough, Staffordshire.*
1854	MACDONALD, Sir ARCHIBALD KEPPEL, Bt., *Woolmer Lodge, Liphook, Hants.*
1839	PORTMAN, Viscount, *Bryanston, Blandford, Dorset.*
1856	POWIS, Earl of, *Powis Castle, Welshpool, Montgomeryshire.*
1858	RUTLAND, Duke of, K.G., *Belvoir Castle (Leicestershire), Grantham.*
1861	WELLS, WILLIAM, *Holmewood (Huntingdonshire), Peterborough.*

Vice-Presidents.

1873	BEDFORD, Duke of, K.G., *Woburn Abbey, Bedfordshire.*
1861	CATHCART, Earl, *Thornton-le-Street, Thirsk, Yorkshire.*
1867	DEVONSHIRE, Duke of, K.G., *Holker Hall, Lancashire.*
1847	EVERSLEY, Viscount, G.C.B., *Heckfield Place, Winchfield, Hants.*
1858	LATHOM, Earl of, *Lathom Hall, Ormskirk, Lancashire.*
1872	LAWES, Sir JOHN BENNET, Bart., *Rothamsted, St. Albans, Herts.*
1865	LOPES, Sir MASSEY, Bart., *Maristow, Roborough, Devon.*
1867	RAVENSWORTH, Earl of, *Ravensworth Castle, Gateshead, Durham.*
1852	RICHMOND AND GORDON, Duke of, K.G., *Goodwood, Chichester, Sussex.*
1869	RIDLEY, Sir M. WHITE, Bart. M.P., *Blagdon, Cramlington, Northumberland.*
1874	SPENCER, Earl, K.G., *Althorp, Northamptonshire.*

Other Members of Council.

1881	ALLENDER, G. MANDER, 31, *St. Petersburgh Place, Bayswater, Middlesex.*
1877	ARKWRIGHT, J. HUNGERFORD, *Hampton Court, Leominster, Herefordshire.*
1880	ASHWORTH, ALFRED, *Tabley Grange, Knutsford, Cheshire.*
1875	AYLMER, HUGH, *West Dereham, Stoke Ferry, Norfolk.*
1871	BOWEN-JONES, J., *Ensdon House, Montford Bridge, R.S.O., Salop.*
1886	CAIRD, JAMES A., *Northbrook, Micheldever, Hants.*
1874	CHANDOS-POLE-GELL, H., *Hopton Hall, Wirksworth, Derbyshire.*
1884	CHAPLIN, HENRY, M.P., *Blankney Hall, Lincoln.*
1883	CLAY, CHARLES, *Walton Grange, Wakefield, Yorkshire.*
1883	COKE, Hon. EDWARD K. W., *Longford Hall, Derbyshire.*
1885	COVENTRY, Earl of, *Croome Court, Severn Stoke, Worcestershire.*
1886	DE LAUNE, C. DE L. FAUNCE, *Sharsted Court, Sittingbourne, Kent.*
1860	DRUCE, JOSEPH, *Eynsham, Oxford.*
1882	EMLYN, Viscount, *Golden Grove, Carmarthen, S. Wales.*

Year when Elected.	
1876	FEVERSHAM, Earl of, *Duncombe Park, Helmsley, Yorkshire.*
1879	FOSTER, SAMUEL P., *Killhow, Carlisle, Cumberland.*
1875	FRANKISH, WILLIAM, *Limber Magna, Ulceby. Lincolnshire.*
1881	GILBEY, WALTER, *Elsenham Hall, Essex.*
1879	GORRINGE, HUGH, *Kingston-by-Sea, Brighton, Sussex.*
1874	HEMSLEY, JOHN, *Shelton, Newark, Notts.*
1876	HOWARD, CHARLES, *Biddenham, Bedford.*
1878	HOWARD, JAMES, *Clapham Park, Bedfordshire.*
1883	JERSEY, Earl of, *Middleton Park, Bicester, Oxfordshire.*
1869	LEEDS, ROBERT, *Keswick Old Hall, Norwich.*
1881	LITTLE, HERBERT J., *Coldham Hall, Wisbech, Cambridgeshire.*
1885	LLOYD, ARTHUR P., *Leaton Knolls, Shropshire.*
1886	MAINWARING, C. S., *Galltfaenan, Rhyl, Denbighshire.*
1874	MARTIN, JOSEPH, *Highfield House, Littleport, Isle of Ely, Cambridgeshire.*
1884	MILLER, T. HORROCKS, *Singleton Park, Poulton-le-Fylde, Lancashire.*
1880	MORETON, Lord, *Tortworth Court, Falfield, R.S.O., Gloucestershire.*
1886	MUNTZ, PHILIP ALBERT, M.P., *Dunsmore, Rugby, Warwickshire.*
1879	NEVILLE, ROBERT, *Butleigh Court, Glastonbury, Somersetshire.*
1881	PARKER, Hon. CECIL T., *Eccleston, Chester.*
1886	PELL, ALBERT, *Hazlebeach, Northampton.*
1861	RANDELL, CHARLES, *Chadbury, Evesham, Worcestershire.*
1871	RAWLENCE, JAMES, *Bulbridge, Wilton, Salisbury, Wilts.*
1875	RUSSELL, ROBERT, *Horton Court Lodge, Dartford, Kent.*
1874	SANDAY, GEORGE H., *Langdale Lodge, Atkins Rd., Clapham Park, Surrey.*
1886	SCARTH, W. T., *Keverstone, Darlington.*
1878	SHERATON, WILLIAM, *Broom House, Ellesmere, Salop.*
1886	SMITH, ALFRED J., *Rendlesham, Woodbridge, Suffolk.*
1882	STAFFORD, Marquis of, M.P., *Trentham Hall, Stoke-upon-Trent, Staffs.*
1875	STRATTON, RICHARD, *The Duffryn, Newport, Monmouthshire.*
1883	SUTTON, MARTIN J., *Dyson's Wood, Kidmore, Reading, Berkshire.*
1881	THOROLD, Sir JOHN H., Bart., *Syston Park, Grantham, Lincolnshire.*
1871	WAKEFIELD, WILLIAM H., *Sedgwick, Kendal, Westmoreland.*
1882	WARREN, REGINALD AUGUSTUS, *Preston Place, Worthing, Sussex.*
1870	WHITEHEAD, CHARLES, *Barming House, Maidstone, Kent.*
1865	WILSON, JACOB, *Chillingham Barns, Belford, Northumberland.*

Secretary and Editor.

H. M. JENKINS, 12, *Hanover Square, London,* **W.**

Consulting Chemist—Dr. J. AUGUSTUS VOELCKER, 12, *Hanover Square,* **W.**
Consulting Botanist—W. CARRUTHERS, F.R.S., F.L.S., *Central House, Central Hill, Norwood,* **S.E.**
Consulting Entomologist—Miss E. A. ORMEROD, F.R.Met.Soc., *Dunster Lodge, Spring Grove, Isleworth.*
Consulting Veterinary Surgeon—Professor JAMES BEART SIMONDS, *St. John's Villa, Ryde, Isle of Wight.*
Veterinary Inspectors—THE OFFICERS OF THE ROYAL VETERINARY COLLEGE.
Consulting Engineer—W. ANDERSON, 3, *Whitehall Place,* **S.W.**
Surveyor and Superintendent of Works—WILSON BENNISON, 66, *Ashley Road, Crouch Hill,* **N.**
Consulting Surveyor—GEORGE HUNT, *Evesham, Worcestershire.*
Seedsmen—THOMAS GIBBS & Co., *Down Street, Piccadilly,* **W.**
Publisher—JOHN MURRAY, 50, *Albemarle Street,* **W.**
Bankers—THE LONDON AND WESTMINSTER BANK, *St. James's Square Branch,* **S.W.**

STANDING COMMITTEES FOR 1886.

Finance Committee.

Kingscote, Colonel (Chairman).
Bridport, General Viscount.
Ridley, Sir M. White, Bt.
Frankish, W.
Randell, Charles.
Sanday, G. H.

House Committee.

Chairman of Finance Committee.
The President.
Bridport, General Viscount.
Randell, C.
Wilson, Jacob.

Journal Committee.

Cathcart, Earl (Chairman).
Jersey, Earl of.
Emlyn, Viscount.
Thorold, Sir J. H., Bt.
Bowen-Jones, J.
Caird, J. A.
Dent, J. D.
Frankish, W.
Howard, J.
Little, H. J.
Wells, W.
Whitehead, Charles

Chemical Committee.

Wells, William (Chairman).
Bedford, Duke of.
Emlyn, Viscount.
Parker, Hon. C. T.
Lawes, Sir J. B., Bt.
Macdonald, Sir A. K., Bt.
Thorold, Sir J. H., Bt.
Arkwright, J. H.
Bowen-Jones, J.
Clay, Charles.
De Laune, C. de L. Faunce.
Dent, J. D.
Howard, C.
Little, H. J.
Neville, R.
Voelcker, Dr.
Wakefield, W. H.
Warren, R. A.
Whitehead, Charles.

Seeds and Plant-Diseases Committee.

Whitehead, Charles (Chairman).
Cathcart, Earl.
Thorold, Sir J. H., Bt.
Arkwright, J. H.
Bowen-Jones, J.
Carruthers, W.
De Laune, C. de L. Faunce.
Frankish, W.
Little, H. J.
Stratton, R.
Sutton, Martin J.

Veterinary Committee.

Thorold, Sir J. H., Bt. (Chairman).
Egerton of Tatton, Lord.
Bridport, General Viscount.
Moreton, Lord.
Coke, Hon. E. K. W.
Parker, Hon. C. T.
Ridley, Sir M. White, Bt
Allender, G. M.
Ashworth, A.
Brown, Professor.
Chaplin, H.
Cope, A. C.
Fleming, George.
Foster, S. P.
Harpley, M. J.
Kingscote, Colonel.
Lloyd, A. P.
Robertson, Professor.
Sanday, G. H.
Simonds, Professor.
Wakefield, W. H.
Wilson, Jacob.

Stock-Prizes Committee.

Wilson, Jacob (Chairman).
Coventry, Earl of.
Bridport, Gen. Viscount.
Moreton, Lord.
Emlyn, Viscount.
Coke, Hon. E. K. W.
Parker, Hon. C. T.
Allender, G. M.
Arkwright, J. H.
Ashworth, A.
Aylmer, H.
Bowen-Jones, J.
Chandos-Pole-Gell, H.
Foster, S. P.
Frankish, W.
Gilbey, Walter.
Gorringe, H.
Hemsley, J.
Howard, C.
Martin, J.
Miller, T. H.
Randell, C.
Sanday, G. H.
Sheraton, W.
Simonds, Professor
Stratton, R.
Wakefield, W. H.
The Stewards of Live Stock.

Implement Committee.

HEMSLEY, J. (Chairman)
BRIDPORT, Gen. Viscount.
MORETON, Lord.
PARKER, Hon. C. T.
THOROLD, Sir J. H., Bt.
ALLENDER, G. M.
ANDERSON, W.
BOWEN-JONES, J.
CLAY, C.
FRANKISH, W.
HOWARD, C.
HOWARD, J.
LITTLE, H. J.
MARTIN, J.
NEVILLE, R.
SANDAY, G. H.
SHERATON, W.
STRATTON, R.
WILSON, JACOB.
The Stewards of Implements.

General Newcastle-on-Tyne Committee.

THE WHOLE COUNCIL, with the following representatives of the LOCAL COMMITTEE:—

BELL, T.
DODS, T. P.
FURNESS, H. M.
GRAY, T.
NEWCASTLE-ON-TYNE, MAYOR OF.
NEWCASTLE-ON-TYNE, TOWN CLERK OF.
STEPHENSON, CHRISTOPHER.
STEPHENSON, CLEMENT
WALLACE, HENRY.

Show-Yard Contracts Committee.

RANDELL, CHARLES (Chairman).
ALLENDER, G. M.
ASHWORTH, A.
CLAY, CHARLES.
FRANKISH, W.
HEMSLEY, J.
HOWARD, C.
SANDAY, G. H.
WILSON, JACOB.

Committee of Selection.

CATHCART, Earl (Chairman).
COVENTRY, Earl of.
EMLYN. Viscount.
PARKER, Hon. C. T.
THOROLD, Sir J., Bt.
GORRINGE, H.
LITTLE, H. J.

And the Chairmen of the Standing Committees.

Education Committee.

MORETON, Lord (Chairman).
JERSEY, Earl of.
EMLYN, Viscount.
THOROLD, Sir J. H., Bt.
BOWEN-JONES, J.
DENT, J. D.
FOSTER, S. P.
KINGSCOTE, Colonel.
LITTLE, H. J.
SUTTON, M. J.
VOELCKER, Dr.

Dairy Committee.

PARKER, Hon. C. T. (Chairman).
BRIDPORT, Gen. Viscount.
EGERTON, Lord.
THOROLD, Sir J. H., Bt.
ASHWORTH, A.
ALLENDER, G. M.
ARKWRIGHT, J. H.
BOWEN-JONES, J.
KINGSCOTE, Colonel.
MAINWARING, C. S.
NEVILLE, R.
SHERATON, W.

Cattle Plague Committee.

THE WHOLE COUNCIL.

*** The PRESIDENT, TRUSTEES, and VICE-PRESIDENTS are Members *ex officio* of all Committees.

Royal Agricultural Society of England.

GENERAL MEETING,

12, Hanover Square, Saturday, May 22nd, 1886.

REPORT OF THE COUNCIL.

The Council have to report the following changes in the list of Members of the Society during the year which has elapsed since the last Annual Meeting in May 1885 :—1 Governor and 421 Members have been elected, 210 have resigned, 2 Governors have been transferred to the list of Members, 12 Governors and 135 Members have died, and 68 Members have been removed from the list by order of the Council.

The Society now consists of :—

70 Life Governors,
61 Annual Governors,
3414 Life Members,
5569 Annual Members,
20 Honorary Members,

making a total of 9134, and showing a decrease of 1 Member since this time last year.

Since the General Meeting of the Society held last December, vacancies in the Council have occurred by reason of the death of the Earl of Chichester (a Vice-President of the Society), Mr. Coxon, and Mr. R. C. Ransome (Members of the Council). Certain of these vacancies, and two others which remained vacant at the date of the last General Meeting, have been filled by the election of Mr. P. A. Muntz, M.P., Mr. C. S. Mainwaring, and Mr. W. T. Scarth, as Members of the Council, as well as the transfer of Sir Matthew White Ridley to the list of Vice-Presidents; while the remaining vacancies are still under the consideration of the Council.

The accounts for the year 1885 have been examined and

certified by the auditors and accountants of the Society, and have been published in the current number of the 'Journal,' together with the statement of Receipts and Expenditure relating to the Preston Meeting. The funded property of the Society is now 31,895*l.* 5*s.* 7*d.*, while the balance of the current account in the hands of the Society's Bankers on the 1st instant, was 6232*l.* 9*s.* 10*d.*, and 2000*l.* remained on deposit.

The Norwich Meeting will commence on Monday morning, July 12th, and close on the following Friday evening; but the Implement portion of the Show and the Working Dairy will be open to Members of the Society and the public on Saturday, July 10th.

In consequence of representations made to the Council that the last date of entry for Live-stock and Dairy Produce was inconveniently early to intending Exhibitors, it has been postponed from May 1st to May 12th, with the further proviso that Post-entries at double-fees will be received up to June 1st. The last date of entry for Poultry remains as before at June 1st.

The Council regret that their offer of Prizes and Certificates for efficiency in Cheese-making at Preston did not attract more than two competitors, and that the Cheeses made by them were not considered by the Judges of sufficiently high quality to entitle the makers to the Society's Certificate. The Butter-makers were more successful, as has been previously announced. The Council have therefore determined to continue the offer of Prizes and Certificates for Butter-workers at the Norwich Country Meeting as last year, but have decided that the offer of Prizes and Certificates to Cheese-makers be subject to the entry of a minimum number of six competitors.

With the object of illustrating as far as possible the different processes of manufacture of Dairy products in the Society's Showyard, the Council have arranged for an addition to the Working Dairy this year, so that the method of making some of the high-priced French Soft Cheeses may be exhibited and explained.

Invitations with regard to the Country Meeting of 1887 having been received by the Council from the authorities of Darlington and Newcastle, a Committee of Inspection was appointed, and deputations from both localities had interviews with the Council. After due consideration it was decided that the Country Meeting of 1887 should be held at Newcastle.

The Country Meeting for the year 1888 will be held in the district which includes the counties of Derby, Leicester, Lincoln, Northampton, Nottingham, and Rutland.

The Judges appointed to decide upon the merits of the Silos competing for the Prize offered by Sir Massey Lopes "for the

best Silo in England and Wales in actual work during the Winter of 1885–86," awarded it to Mr. J. Morris, of Lulham Court, Madley, Herefordshire; and upon their recommendation the Council granted Silver Medals to Mr. W. J. Harris, of Halwell Manor, Highampton, Devon; Mr. T. Kirby, of Hook Farm, Bromley; and Mr. C. F. Trepplin, of Kenilworth, Warwickshire. The Prize for a Silo-stack offered by the Society was awarded to Mr. C. G. Johnson, of Oakwood, Croft, Darlington; and the Aylesbury Dairy Company were highly commended.

The Special Committee appointed by the Council to consider how far the Society can co-operate with the Local Agricultural Societies in carrying out investigations into subjects of practical utility to Agriculture, have had several conferences with representatives of certain County Societies; and they have arranged the following scheme for present requirements:—

That the Royal Agricultural Society should, on application from a Local Society, either suggest one or more Experiments themselves, or endorse, after examination and approval, any Experiment proposed by the Local Society, and should give assistance in the following manner:—

1. By analysing, at the cost of the Royal Agricultural Society, the soil, manures, and feeding stuffs.
2. By the advice generally of the Chemist of the Royal Agricultural Society, in conjunction with Sir J. B. Lawes and Dr. Gilbert.
3. By an occasional inspection from time to time.
4. By furnishing a Report on the Experiments, to be inserted, if thought well, in the 'Journal.'
5. By having at Woburn, if thought advantageous to do so, similar Experiments for comparison.
6. By the distribution among the Local Society of schemes of the proposed Experiments, and the results obtained.

The Local Society to satisfy the Council of the Royal Agricultural Society of the efficiency of the Local Superintendence.

Up to the present time arrangements have been made with the Royal Manchester, Liverpool, and North Lancashire Society, the Yorkshire and Essex Agricultural Societies, and the Norfolk Chamber of Agriculture. The Council trust that this system of co-operation may be productive of good results, and in that case be largely extended.

Applications having been made to the Council to facilitate

Experiments on the growth and curing of Tobacco in England, they came to the conclusion that it was too late to commence such an experiment this year, and otherwise did not consider it expedient to make a grant from the funds of the Society for the purpose. In the event of the Treasury consenting to defray the expenses of such an experiment next year, the Council will, if desired, be prepared to provide the necessary skilled supervision, both for the growth and the curing of the Tobacco plant.

Having regard to the increasing importance of the system of inoculation with attenuated virus as a means of preventing diseases in animals of the farm, the Council have decided to send Professor Robertson, with a qualified Veterinary Surgeon, to study Mons. Pasteur's system at Paris; and they are glad to report that Mons. Pasteur has expressed his willingness to receive them for that purpose.

The examiners of the Royal College of Veterinary Surgeons have reported that the two students who passed best in the subject of the Pathology of Cattle, Sheep, and Pigs at the recent Diploma Examination, and who thereby became entitled to the Society's Medals, were:—

Mr. Alfred Cawdle, Kimbolton, Hunts, Silver Medal.

Mr. Charles Heinemann, St. Peter's Road, Mile End, Bronze Medal.

In addition to the Field Experiments, which have been carried on as in former years, a set of Feeding Experiments, bearing on the value of Ensilage, have been conducted at Crawley Mill Farm, and these being just concluded, will form the subject of a Paper in the next number of the 'Journal.' An experiment on Sheep-feeding has also been made, and will be communicated at the same time. Further Experiments on the growth of Clover, together with fresh ones on laying down Land to Grass will be made during the present year.

The Consulting Botanist has found a decided improvement in the Seeds supplied to the Members of the Society. The difficulty still presents itself of obtaining Fiorin free from Ergot, and Red Clover free from Dodder. The presence of Ergot in large quantities in hay with which cows were being fed, clearly established that in this case abortion was due to this fungus. Weeds and useless grasses are largely introduced in the mixtures employed for laying land down to pasture. Several extremely dirty samples have been brought under the notice of the Consulting Botanist. Some samples consisted entirely of Yorkshire fog: others were full of injurious weeds.

The communications upon subjects concerning the prevention

of the ravages of Insects have been very numerous during the past year. Many enquiries were made of the Consulting Entomologist in the spring and summer with regard to insects that were attacking various crops. These related mainly to insects not so generally known as the Wire-worm, Turnip-fly, and Daddy Longlegs, upon which full information has been given in the reports of previous years.

The Ox Warble-fly has been the subject of much correspondence both with Cattle-owners and persons connected with the Leather trade, and a marked absence of maggots is reported in localities where measures recommended for adoption were carried out last year.

It is highly satisfactory to find that much more intelligent attention is being directed by agriculturists to the nature of insects injurious to crops, and to methods of prevention against their attacks.

Twenty-three Candidates entered themselves for the recent Examination for the Society's Senior Prizes and Certificates, and of this number twenty-two presented themselves on May 11th and following days:—

The following Candidates, placed in order of merit, obtained First-Class Certificates and the Life Membership of the Society, besides qualifying for the prizes as stated below:—

Bentham Simpson, Wardour Villa, Bethune Road, Stoke Newington, 25*l.*

Byomkes Chakravarti, Royal Agricultural College, Cirencester, 15*l.*

John Thomas Davies, Royal Agricultural College, Cirencester, 10*l.*

D. Lal Roy, Royal Agricultural College, Cirencester, 5*l.*

In addition to the above, a Second-Class Certificate was gained by Walter Frank Perkins, Royal Agricultural College Cirencester.

The Council are glad to notice this increase in the number of the Candidates over those entered of late years, as indicating a greater desire for instruction in the sciences connected with Agriculture.

By Order of the Council,

H. M. JENKINS,

Secretary.

ROYAL AGRICULTURAL

Dr. HALF-YEARLY CASH ACCOUNT

	£ s. d.	£ s. d.	£ s. d.
To Balance in hand, 1st January, 1886:—			
Bankers		1,503 6 10	
Secretary		53 9 2	
			1,556 16 0
To Income:—			
Dividends on Stock		433 6 8	
Subscriptions:—			
Governors' Annual	255 0 0		
Members' Life-Compositions	614 0 0		
Members' Annual	4,221 13 0		
		5,090 13 0	
Establishment:—			
Rent		210 0 0	
Journal:—			
Sales	68 14 2		
Advertisements	149 7 3		
Sale of Pamphlets	5 10 10		
		223 12 3	
Chemical:—			
Laboratory Fees		175 3 3	
Education:—			
Sale of Insect Diagrams		3 0 4	
Sundries		1 13 1	
Preston Meeting		49 11 0	
Total Income		.. .. ..	6,186 19 7
To Norwich Meeting		.. .. ..	7,115 15 0
			£14,859 10 7

BALANCE-SHEET,

LIABILITIES.	£ s. d.	£ s. d.	£ s. d.
To Capital:—			
Surplus, 31st December, 1885		37,727 10 8	
Surplus of Income over Expenditure during the Half-year, viz.:—			
Income	6,186 19 7		
Expenditure	3,934 11 5		
		2,252 8 2	
			39,979 18 10
Deduct half-year's interest and depreciation on Country Meeting Plant		.. .. ..	233 14 10
			£39,746 4 0

QUILTER, BALL, & CO., *Accountants.*

SOCIETY OF ENGLAND.

FROM 1ST JANUARY TO 30TH JUNE, 1886. Cr.

	£ s. d.	£ s. d.	£ s. d.
By Expenditure:—			
Establishment:—			
Salaries, Wages, &c.	916 10 0		
House:—Rent, Taxes, Repairs, &c.	413 19 9		
Office:—Printing, Postage, Stationery, &c.	398 8 5		
		1,728 18 2	
Journal:—			
Printing and Stitching	648 10 3		
Printing Advertisements	59 16 0		
Postage and Delivery	225 0 0		
Literary Contributions	167 10 0		
Engravings and Electros	14 7 11		
Printing Pamphlets	10 12 0		
		1,125 16 2	
Chemical:—			
Salaries	338 4 0		
Instruments and Chemicals	41 6 7		
Petty Payments	26 3 0		
		405 13 7	
Veterinary:—			
Professional Fee		5 0 0	
Seeds and Plants Diseases:—			
Consulting Botanist's Salary	50 0 0		
Consulting Entomologist's Salary	50 0 0		
		100 0 0	
Education:—			
Fees to Examiners	52 10 0		
Advertising and Printing	40 6 3		
Prizes	55 0 0		
		147 16 3	
Sundries:—			
Silo Judges (balance)	199 4 4		
„ Prizes	130 0 0		
„ Medals	7 6 0		
Expenses of Inspection Committee	31 14 11		
Gratuity to Dairymaid	25 0 0		
		393 5 3	
Subscriptions returned (paid in error)		3 2 0	
Preston Meeting		25 0 0	
Total Expenditure			3,934 11 5
By Country Meeting Plant			57 0 0
By Norwich Meeting			8,055 8 1
By Balance in hand, 30th June:—			
Bankers	711 3 0		
Secretary	101 8 1		
		812 11 1	
At Deposit		2,000 0 0	
			2,812 11 1
			£14,859 10 7

30TH JUNE, 1886.

ASSETS.	£ s. d.	£ s. d.
By Cash in hand	812 11 1	
By New 3 per Cent. Stock 29,885*l.* 4*s.* 4*d.* cost *	29,177 17 1	
By Consols 2,010*l.* 1*s.* 3*d.* cost †	2,000 0 0	
By Books and Furniture in Society's House	1,451 17 6	
By Country Meeting Plant	2,882 18 7	
By Deposit Account	2,000 0 0	
		38,325 4 3
At Debit of Norwich Meeting		1,420 19 9
		£39,746 4 0

* *Value at* 101¼ = 30,333*l.* 9*s.* 10*d.*
† *Value at* 101½ = 2,040*l.* 4*s.* 3*d.*

Mem.—The above Assets are exclusive of the amount recoverable in respect of arrears of Subscriptions to 30th June, 1886, which at that date amounted to 2,585*l.*

Examined, audited, and found correct, this 30th day of August, 1886.

FRANCIS SHERBORN,
A. H. JOHNSON,
C. GAY ROBERTS,
} *Auditors on behalf of the Society.*

NORWICH MEETING, 1886.

STEWARDS OF DEPARTMENTS.

Implements.

SIR JOHN H. THOROLD, BART.
H. J. LITTLE.
J. HEMSLEY.

Live Stock.

ALFRED ASHWORTH.
THE EARL OF COVENTRY.
VISCOUNT EMLYN.
W. H. WAKEFIELD.

Working Dairy.

SIR JOHN H. THOROLD, BART.

Poultry and Dairy Produce.

HUGH GORRINGE.

Forage.

GARRETT TAYLOR.

Finance.

WILLIAM FRANKISH. | G. H. SANDAY.

General Arrangements.

JACOB WILSON.

JUDGES OF IMPLEMENTS.

JAMES EDWARDS. | T. H. THURSFIELD. | JOHN WHEATLEY.

JUDGES OF STOCK, &c.

HORSES.

Shire.

JOSEPH HILL.
WILLIAM LITTLE.
T. S. MINTON.

Clydesdales or Agricultural.

J. CUNNINGHAM.
R. MACHIN.
A. RALSTON.

Suffolks.

J. E. CHAPMAN.
THOMAS GIRLING.
WILLIAM THOMPSON.

Thoroughbreds and Hunters.

COLONEL RIVERS BULKELEY.
J. BLENCOWE COOKSON.
C. B. ROBSON.

Hackneys and Ponies.

WALTER GILBEY.
ROMER WILLIAMS.
C. W. WILSON.

Harness.

JAMES HORNSBY.
CLEMENT STEPHENSON.

CATTLE.

Shorthorns.

HUGH AYLMER.
CHARLES HOWARD.
JOHN WOOD.

Herefords and Welsh.

T. FENN.
JOHN WHITE.
J. WILLIAMS.

Devons and Sussex.

ALFRED AGATE.
H. W. KEARY.
H. QUARTLY.

Red Polled.

ROBERT BRUCE.
ROBERT COOKE.
GEORGE NAPPER.

Jersey and Guernsey.

T. FALLA, JUN.
J. F. HALL.
H. A. RIGG.

Dairy and other Breeds.

LUKE CHRISTY.
W. GRAHAM.
RICHARD STRATTON.

SHEEP.

Leicesters, Cotswolds, Lincoln, and other Long-Woolled.

WILLIAM T. GARNER.
HENRY SMITH.
G. WALMSLEY.

Oxfordshire Down.

C. HOBBS, SEN.
J. A. MILES.

Shropshire.

R. BARBER.
J. E. FARMER.

Southdown.

A. W. CRISP.
HUGH PENFOLD.

Hampshire, Suffolks, and other Short-Woolled, and Cross-Breds.

GEORGE KING.
JOHN SHERWOOD.
JAMES W. STANFORD.

PIGS.

White Breeds.

PETER EDEN.
JAMES LONG.
JOSEPH SMITH.

Black and Red Breeds.

HERMAN BIDDELL.
HEBER HUMFREY.

INSPECTORS OF SHEARING.

WILLIAM JOBSON. | J. B. WORKMAN.

JUDGES OF CHEESE AND BUTTER.

HENRY OVERMAN. | JUBAL WEBB. | JAMES WATSON, M.P.

JUDGES OF POULTRY.

D. BRAGG. | O. E. CRESSWELL. | BUTLER SMITH.

JUDGES OF BEES AND BEE-KEEPING APPLIANCES.

JOHN M. HOOKER. | F. G. JENYM. J. L. SEAGER. | GEORGE RAYNOR.

JUDGES OF FARMS.

W. JONAS. | W. J. MOSCROP. | G. RUTHERFORD.

AWARD OF PRIZES.

NOTE.—The Judges were instructed, in addition to awarding the Prizes, to designate as the *Reserve Number* one animal in each Class, next in order of merit, if it possessed sufficient for a Prize; in case an animal to which a Prize was awarded should subsequently become disqualified.

Prizes given by the Norwich Local Committee are marked thus (*).

HORSES.

CLASS 1.—*Shire Stallions foaled in the Year* 1883.

15 THOMAS BROWN, Marham Hall, Downham Market, Norfolk : FIRST PRIZE, 25*l.*, and CHAMPION PRIZE, 25*l.*,† for "Julian" (3766), black; bred by himself; sire, "Lord Byron" (351); dam, "Jewel," by "Brown Champion" (292).

12 THE CANNOCK AGRICULTURAL COMPANY, Limited, Longhouse Stud Farm, Cannock, Staffs: SECOND PRIZE, 15*l.*, for "Hatherton" (4443), bay; bred by Mrs. Jones, Vernor, Newtown, Montgomeryshire; sire, "Duke of Cambridge II." (3607); dam, "Derby," by "King Dick" (1213).

8 THE EARL OF ELLESMERE, Ferry Hill Farm, Chatteris, Cambridgeshire: THIRD PRIZE, 5*l.*, for "Teamsman" (4083), grey; bred by himself; sire, "Lincolnshire Lad II." (1365); dam, "Florence," by "Royal George" (1892).

6 JAMES FORSHAW, Blyth, Worksop, Notts, the *Reserve Number* and *Highly Commended* for "Blyth William" (4260), bay; bred by Mr. J. Waterworth, North Ashton, Wigan, Lancashire; sire, "William the Conqueror" (2343); dam, "Rose," by "Honest Tom" (1105).

CLASS 2.—*Shire Stallions foaled in the Year* 1884.

34 HENRY BROWNE, Bury Hall, Huntingdon : FIRST PRIZE, 25*l.*, and the *Reserve Number* for Champion Prize, for "Hitchin Emperor," brown; bred by Mr. A. Ransom, Hitchin, Herts; sire, "Helmdon Emperor;" dam, "Blaze," by "Heart of Oak" (1005).

37 WALTER GILBEY, Elsenham Hall, Essex : SECOND PRIZE, 15*l.*, for "Real Briton" (4641), bay; bred by Mr. V. Eastgate, Holbeach, Lincolnshire; sire, "True Briton" (2684); dam, "Brisk," by "Matchless" (1542).

25 THE EARL OF ELLESMERE, Ferry Hill Farm, Chatteris, Cambridgeshire: THIRD PRIZE, 5*l.*, for "Shrewsbury" (4681), bay; bred by himself; sire, "Esquire" (2774); dam, "Darling," by "Edmonson's England's Glory."

36 THOMAS HORROCKS MILLER, Singleton Park, Poulton-le-Fylde, Lancashire: the *Reserve Number* and *Highly Commended* for "Major General," bay; bred by himself; sire, "Lincoln" (1350); dam, "Harvest Maid," by "Ploughboy" (1745).

† Given by the Shire-horse Society.

CLASS 3.—*Shire Stallions foaled in the Year* 1885.

46 WALTER GILBEY, Elsenham Hall, Essex: FIRST PRIZE, 15*l.*, for "Brother Glow," bay; bred by himself; sire, "Spark" (2497); dam, "Carol," by "Honest Prince" (1058).

40 LORD WINMARLEIGH, Winmarleigh, Garstang, Lancashire: SECOND PRIZE, 10*l.*, for "Wolseley," chestnut; bred by himself; sire, "Garnet" (2787); dam, "Winmarleigh Lass," by "Sir Colin" (2022).

44 JOHN ROWELL, Manor Farm, Bury, Huntingdonshire: THIRD PRIZE, 5*l.*, for "Premier Prince," brown; bred by Mr. W. H. Potter, The Grounds, Lockington, Derbyshire; sire, "Premier" (2646); dam, "Lockington Beauty," by "Champion" (457).

39 ANDERSON WELLS RICHMAN, Swavesey, Cambridgeshire: the *Reserve Number* for "Don," bay; bred by himself; sire, "Prince" (2480); dam, "Queen Bess," by "Royal Tom" (2662).

CLASS 4.—*Clydesdale Stallions foaled in the Year* 1883.

55 WALTER S. PARK, Hatton Farm, Bishopston, Renfrewshire: FIRST PRIZE, 25*l.*, for "Sir Hildebrand" (4024), bay; bred by Mr. J. M. Martin, Auchendennan Farm, Balloch, N.B.; sire, "Belted Knight" (1395); dam, "Darling" (241), by "Lintock Galbraith."

48 GEORGE RODGER, Newton Bank, Preston Brook, Cheshire: SECOND PRIZE, 15*l.*, for "Little Jock Elliott" (3768), bay; bred by himself; sire, "Macgregor" (1487); dam, "Dawn of Mystery" (2895), by "Prince Charlie" (629).

49 THE MARQUESS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: THIRD PRIZE, 5*l.*, for "Vanguard" (4768), brown; bred by himself; sire, "The Viscount" (2477); dam, "Eva" (2479), by "Prince Charlie" (628).

52 JAMES KILPATRICK, Craigie Mains, Kilmarnock, Ayrshire: the *Reserve Number* for "Knight of Ellerslie" (3737), bay; bred by Mr. A. Paton, Knockendale, Symington, Ayrshire; sire, "Prince of Wales" (673); dam, "Lillie of Knockendale" (2800), by "Young Champion" (934).

CLASS 5.—*Clydesdale Stallions foaled in the Year* 1884.

60 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, Kirkcudbright: FIRST PRIZE, 25*l.*, for "Macphail" (4567), bay; bred by Messrs. Kerr and Craig, Auchengool, Castle Douglas; sire, "Macgregor" (1487); dam, "Bet" (2417), by "Prince" (609).

57 GEORGE RODGER, Newton Bank, Preston Brook, Cheshire: SECOND PRIZE, 15*l.*, for "Warpaint" (4773), bay; bred by Mr. R. Vans Agnew, Barnbarrock, Whauphill, Wigtownshire; sire, "Warrior" (902); dam, "Nancy Lee" (1875), by "Bonnie Scotland" (1076).

67 THE DUKE OF PORTLAND, Welbeck, Worksop, Nottinghamshire: THIRD PRIZE, 5*l.*, for "Holyrood," roan; bred by Mr. A. McCowan, Newtonairds, Dumfries; sire, "Auld Reekie" (1920); dam, "Kate of Banks" (2612), by "Young Ross" (1370).

66 RICHARD B. BROCKBANK, Crosby, Maryport, Cumberland: the *Reserve Number* for "Maccombie" (4585), bay; bred by Mr. Maxwell Clarke, Culmain; sire, "Macgregor" (1487); dam, "Doll of Culmain" (55), by "Lochfergus Champion" (449).

CLASS 6.—*Clydesdale Stallions foaled in the Year* 1885.

69 ANDREW MONTGOMERY, Nether Hall, Castle Douglas, Kirkcudbright: FIRST PRIZE, 15*l.*, for his brown; bred by Mr. James Robertson, Mains, Twynholm, Kirkcudbright; sire, "Mac Gregor" (1487); dam, "Darling" (2884), by "Robert Burns" (702).

70 THE MARQUESS OF LONDONDERRY, Seaham Hall, Seaham Harbour, Co. Durham: SECOND PRIZE, 10*l.*, for his brown; bred by himself; sire, "Prince of Wales" (673); dam, "Olive" (2476), by "Young Lord Lyon" (3321).

74 THE REV. JOHN GILLESPIE and R. W. MUNN, Meikleholm, Dunholm, Lincolnshire: THIRD PRIZE, 5*l.*, for "The Antiquary," bay; bred by Mr. James Watson, Badallan, Fauldhouse, N.B.; sire, "Commander" (2029); dam, "Darling" (5132), by "Prince of Carstairs" (1505): and the *Reserve Number* for (73), "Gilbert Glossin," brown; bred by Mr. Gavin Rankin, Glenboig, Airdrie, Lanarkshire; sire, "Master of Blantyre" (2283); dam, "Young Lizzie" (1661), by "Crown Prince Lochburn" (207).

CLASS 7.—*Suffolk Stallions foaled previously to the Year* 1883.†

82 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: FIRST PRIZE, 25*l.*, and CHAMPION PRIZE, 25*l.*,‡ for "Easton Emperor," chestnut; was foaled in 1879, bred by Mr. M. Mumford, Creeting St. Peter's, Suffolk; sire, "Bismarck" (1301); dam by "Harwich Emperor" (1025).

84 ROBERT EDGAR, Knight's Hill, Crockfield, Sudbury, Suffolk: SECOND PRIZE, 15*l.*, for "Leiston" (1415), chestnut; was foaled in 1878; bred by Messrs. Rope, Lower Abbey Farm, Leiston; sire, "Cupbearer III."; dam, "Doughty" (755), by "Chillesford Duke" (395).

87 MANFRED BIDDELL, Playford, Ipswich: THIRD PRIZE, 5*l.*, for "Foxhall" (1423), chestnut; was foaled in 1881; bred by Mr. A. B. Biddell, Foxhall, Ipswich; sire, "Rodney" (161); dam, "Foxhall Depper" (67), by "Captain Snap" (142).

78 WILLIAM WILSON, Baylham Hall, Ipswich, Suffolk: the *Reserve Number* and *Commended* for "Banker," chestnut; was foaled in 1881; bred by Mr. J. Lawton, Darmsden, Needham Market; sire, "Wilson's Old Briton."

CLASS 8.—*Suffolk Stallions foaled in the Year* 1883.

98 MANFRED BIDDELL, Playford, Ipswich, Suffolk: FIRST PRIZE, 25*l.*, for "Abbot" (1504), chestnut; bred by Messrs. Rope, Leiston, Saxmundham, Suffolk; sire, "Cupbearer III." (566); dam, "Rope's Moggy."

95 ALFRED J. SMITH, Rendlesham, Woodbridge, Suffolk: SECOND PRIZE, 15*l.*, for "Prince of May" (1586), chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "May Queen" (837), by "Prince Imperial" (1239).

91 ROBERT EMLYN LOFFT, Trosham Hall, Bury St. Edmund's, Suffolk: THIRD PRIZE, 5*l.*, for "Jolly Boy" (1445), chestnut; bred by himself; sire, "Britone" (1414); dam, "Princess" (606), by "Heir Apparent" (1295).

---

† Given by the Suffolk Agricultural Association.
‡ Given by Gurney Buxton, Esq., for the best Suffolk Stallion.

99 ISHMAEL PRATT, Foxboro' Hall Farm, Melton, Woodbridge, Suffolk: the *Reserve Number* and *Commended* for "Hero," chestnut; bred by Mr. J. Catchpool, Abbey Farm, Leatheringham, Wickham Market; sire, "Wantesden Duke;" dam by "Statesman."

CLASS 9.—*Suffolk Stallions foaled in the Year* 1884.

102 ROBERT EDGAR, Knight's Hill, Cockfield, Sudbury, Suffolk: FIRST PRIZE, 20*l.*, for "West Suffolk" (1574), chestnut; bred by himself; sire, "Leiston" (1415); dam, "Foxhall Lass" (1374), by "Ben" (139).

108 MANFRED BIDDELL, Playford, Ipswich: SECOND PRIZE, 10*l.*, for "Pioneer" (1495), chestnut; bred by Mr. Freeman, Stonham Apsal, Ipswich; sire, "Vanguard" (1327); dam, "Matchet" (1232), by "Captain Snap" (142).

100 HORACE WOLTON, Newbourn Hall, Woodbridge, Suffolk: THIRD PRIZE, 5*l.*, for "Dame's Cupbearer" (1456), chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "Dame of Newbourn" (1031), by "Royalty" (1339).

101 ALFRED J. SMITH, Rendlesham, Woodbridge: the *Reserve Number* and *Highly Commended* for "The Beau" (1493), chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "Hasketon Belle" (1233), by "Abbot Sampson" (1096).

CLASS 10.—*Suffolk Stallions foaled in the Year* 1885.

112 HORACE WOLTON, Newbourn Hall, Woodbridge: FIRST PRIZE, 15*l.*, for "Emperor" (1611), chestnut; bred by himself; sire, "Diadem" (1553); dam, "Victoria of Newbourn" (1055), by "Royal Duke II." (1366).

117 WILLIAM BYFORD, The Court, Glemsford, Suffolk: SECOND PRIZE, 10*l.*, for his chestnut; bred by himself; sire, "Jumbo"; dam, "Barmaid" (143), by "Active" (230).

113 SAMUEL TOLLER, Letheringham Lodge, Wickham Market, Suffolk: THIRD PRIZE, 5*l.*, for "Nonpareil," chestnut; bred by himself; sire, "Chieftain" (1354); dam, "Duchess" (928), by "Prince Imperial" (1239).

118 CHARLES AUSTIN, Brandeston Hall, Wickham Market: the *Reserve Number* and *Highly Commended* for "Pilgrim," chestnut; bred by himself; sire, "Wanderer"; dam, "Matchett" (227), by "Conqueror" (247).

CLASS 11.—*Agricultural Stallions, not qualified to compete as Shire, Clydesdale, or Suffolk.**

124 DAVID RIDDELL, Blackhall, Paisley, Renfrewshire: FIRST PRIZE, 25*l.*, for "Prince of Avondale," bay; was foaled in 1880; bred by the late Mr. Lawrence Drew, Merryton, Hamilton, N.B.; sire, "Prince of Wales"; dam, "Juno," by "Ploughboy."

120 TOMMY MILNES, Keel House, Brighouse, Yorkshire: SECOND PRIZE, 15*l.*, for "Lucky Boy," bay; was foaled in 1882, bred by himself; sire, "Luck"; dam, "Baroness," by Jagg's "Lofty."

121 ROBERT WORTLEY, Suffield, Aylsham, Norfolk: THIRD PRIZE, 5*l.*, for "Wonder of the East," black; was foaled in 1882; bred by himself; sire, "Norfolk Wonder"; dam by "Garibaldi."

Class 12.—*Thoroughbred Stallions suitable for getting Hunters.*

129 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market, Suffolk: First Prize, 50*l.*, for "Scot Guard," grey; was foaled in 1877; bred by the late Lord Scarborough, Rotherham, Yorkshire; sire, "Strathconan"; dam, "Reveille," by "Rataplan."

133 Colonel F. Barlow, Hasketon, Woodbridge, Suffolk: Second Prize, 20*l.*, for "Friar Rush," chestnut; was foaled in 1876: bred by Lord Alington, Critchel, Wimborne, Dorset; sire, "Hermit"; dam, "Fusee," by "Marsyas."

131 The Compton Stud Company, Sherborne, Dorset: Third Prize, 10*l.*, for "Huguenot," chestnut; was foaled in 1878: bred by Sir C. Strickland, Bart.; sire, "Lowlander"; dam, "Eurydice," by "Orpheus."

132 John Grout, Woodbridge, Suffolk; the *ReserveNumber* for "Truefit," chestnut, was foaled in 1880; bred by Mr. Charles Snewing, Holywell Farm, Watford, Herts; sire, "Outfit"; dam, "Eleonora," by "Wild Dayrell."

Class 13.—*Hackney Stallions, above* 15 *hands, foaled previously to the Year* 1883.*

148 John Grout, Woodbridge, Suffolk: First Prize, 20*l.*, and the *Reserve Number* for Champion Prize, for "Confidant," brown; was foaled in 1882; bred by Mr. George Jones, Stow Bardolph, Norfolk; sire, "Confidence" (158); dam, "Spider," by "Gentleman" (301).

138 Lewis James Shirley, Caira Stud Farm, Cardiff: Second Prize, 10*l.*, for "Lord Bang" (1030), red roan; was foaled in 1880; bred by Mr. Isaac J. Bays, Primrose Hill, Chatteris, Cambs.; sire, "Great Shot"; dam, "Primrose," by "Old Perfection."

140 William Dunham, Bridewell Street, Wymondham, Norfolk: Third Prize, 5*l.*, for "Confidence," brown; was foaled in 1867; bred by Mr. Rose, Dykebeck, Wymondham; sire, "Prickwillow"; dam by "Highflyer."

141 Charles E. Cooke, Litcham, Swaffham, Norfolk: the *Reserve Number* and *Highly Commended* for "Canvasser" (114), black; was foaled in 1881; bred by Mr. H. Harrison, West Lexham, Swaffham; sire, "Confidence" (158): dam, "Washington" (852), by "Shepherd F. Knapp."

Class 14.—*Hackney Stallions, above* 14 *hands, and not exceeding* 15 *hands, foaled previously to the Year* 1883.

157 John Sindall, Prickwillow, Ely, Cambridgeshire; First Prize, 20*l.*, and the Champion Prize, 25*l.*,† for "British Prince," black; was foaled in 1879; bred by himself, sire, "Reality" (665); dam, "Duchess" (88), by "Clear the Way" (138).

153 Smith Flanders, Littleport Bridge, Littleport, Cambridgeshire: Second Prize, 10*l.*, for "Prince Victor" (1327), chestnut: was foaled in 1882; bred by himself; sire, "Reality" (665); dam, "Kitty" (449), by "Perfection."

---

† Given by Gurney Buxton, Esq., for the best Hackney or Pony Stallion in Classes 13 to 16.

155 John Grout, Woodbridge, Suffolk: Third Prize, 5*l.*, for "Clockwork" (143), chestnut; was foaled in 1880; bred by Mr. D. J. Belding, South Creake, Fakenham, Norfolk; sire, "Little Model"; dam by "Cotherstone."

151 Charles Groucock, Wymondham, Norfolk: the *Reserve Number* and *Highly Commended* for "Gray Tom," grey; was foaled in 1882; bred by Mr. John Youngman, Downham, Norfolk; sire, "Confidence."

Class 15.—*Hackney Stallions foaled in either* 1883 *or* 1884.

175 John Grout, Woodbridge, Suffolk: First Prize, 20*l.*, for "All Fours," chestnut; was foaled in 1884; bred by himself; sire, "Fashion."

168 John N. Anthony, Sedgeford, Lynn, Norfolk: Second Prize, 10*l.*, for "Physician," red roan; was foaled in 1884: bred by Mr. Richard Burgess, Docking, Lynn; sire, "Great Shot" (329).

170 William Beart, Stow Bardolph, Downham Market, Norfolk: Third Prize, 5*l.*, for "Paragon" (1320), brown; was foaled in 1883; bred by the late Mr. Charles Beart, Stow Bardolph; sire, "Confidence" (158); dam, "Sweetbriar," by "Ambition" (26).

164 Frederick E. Howell, Little Walsingham, Norfolk: the *Reserve Number* and *Highly Commended* for "Premier," chestnut; was foaled in 1884; bred by Mr. S. Bell, Stifkey, Norfolk; sire, "Model"; dam by "Inchcolm."

Class 16.—*Pony Stallions above* 13 *hands and not exceeding* 14 *hands.*

181 Dalton Vassar, Barnham Broom, Wymondham, Norfolk: First Prize, 15*l.*, for "Barnham Confidence" (895), brown; was foaled in 1883; bred by himself; sire, "Confidence" (158); dam by "Norfolk Phenomenon" (527).

184 Messrs. Gottwaltz and Bowring, The Horse Exchange, Cardiff, Glamorganshire: Second Prize, 10*l.*, for "Pomfret Wonder," black; was foaled in 1880; bred by Mr. Wright, Doncaster; sire, "Little Wonder"; dam by "St. George."

179 George Mann Nicholson, Brisley, East Dereham, Norfolk; Thipd Prize, 5*l.*, for "Pick Up" (1087), bay; was foaled in 1881; bred by Mr. Huggins, Hempton, Fakenham, Norfolk; sire, "Model" (1054).

178 Samuel Rose, Godmanchester, Huntingdonshire: the *Reserve Number* for "Lord Magpie," black and white; was foaled in 1883; breeder unknown.

Class 17.—*Shire Mares and Foals.*

190 The Earl of Ellesmere, Ferry Hill Farm, Chatteris, Cambridgeshire: First Prize, 20*l.*, for "Lady Lincoln," brown; was foaled in 1879 (foal by "Briton's Boast" (3004)); bred by Mr. J. H. Smith, Alvaston, Derby; sire, "Lincolnshire Lad II." (1365); dam by "Devonshire" (594).

185 Robert Millington Knowles, Calston Bassett Hall, Bingham, Nottinghamshire: Second Prize, 10*l.*, for "Pride of Colston," black; was foaled in 1880 (foal by "Bar None" (2388)); bred by Mr. W. H. L. Clare, Leicester; sire, "Ace of Trumps" (17); dam, "Diamond," by "Nonpareil" (1652).

192 The Hon. E. K. W. Coke, Longford, Derbyshire: Third Prize, 5*l*., for "Comfort," bay; was foaled in 1881 (foal by "Charter" (2740)); bred by Mrs. Williams, Barrow-on-Trent, Derbyshire; sire, "What's Wanted" (3397); dam, "Flower," by "Crown Prince" (558).

188 Walter Gilbey, Elsenham Hall, Essex: the *Reserve Number* and *Highly Commended* for "Startling," roan; was foaled in 1881 (foal by "Spark" (2497)); bred by himself; sire, "Champion" (2410); dam, "Evening Star," by "Major" (1467).

Class 18.—*Clydesdale Mares and Foals.*

201 The Duke of Portland, Welbeck Abbey, Worksop, Nottinghamshire: First Prize, 20*l*., for "Rosewater," bay; was foaled in 1882 (foal by "Grange" (3671)); bred by Mr. R. F. Dunnflamer, Dunragit, Wigtownshire; sire, "Lord Lyon" (489); dam, "Nell of Dunnflammer" (520), by "Farmer" (286).

197 Charles James Lucas, Warnham Court, Horsham, Sussex: Second Prize, 10*l*., for "Millie of Warnham," bay; was foaled in 1881 (foal by "Prince Charlie"); bred by the Earl of Strathmore, Glamis, Forfar, N.B.; sire, "Lord Lyon" (489); dam, "Dora" (115), by "Victor" (892).

195 H.R.H. The Prince of Wales, K.G., Sandringham: Third Prize, 5*l*., for "Violet," bay, was foaled in 1877 (foal by "Marshland Prince"): bred by Mr. Lawrence Drew, Merryton, Hamilton, N.B.; sire, "Prince of Wales;" dam, "Old Rosie," by "Loch Fergus Champion."

196 The Duke of Richmond and Gordon, K.G., Goodwood, Chichester, Sussex: the *Reserve Number* for "Lady Florence" (2859), bay, was foaled in 1879 (foal by "Prince Charlie"); bred by himself; sire, "Prince Albert Victor" (617); dam, "Duchess of Beaufort" (362), by "Sir Robert" (187).

Class 19.—*Suffolk Mares and Foals.*

204 Horace Wolton, Newbourn Hall, Woodbridge, Suffolk: First Prize, 20*l*., and Champion Prize, 25*l*.,† for "Queen of Newbourn" (1049), chestnut; was foaled in 1875 (foal by "Diadem" (1553)); bred by Exhibitor; sire, "Captain Snap" (142); dam, "Duchess of Newbourn" (1032), by "Warrior" (1353).

206 The Duke of Hamilton and Brandon, K.T., of Easton Park, Wickham Market: Second Prize, 10*l*., for "Belle of the Ball" (415), chestnut; was foaled in 1874 (foal by "The Wanderer"); bred by Mr. C. Frost, Wherstead, Ipswich; sire, "A Son of May Duke"; dam, by "Hero."

209 Nathaniel Catchpole, Whitton White House, Bramford, Ipswich: Third Prize, 5*l*., for his chestnut; was foaled in 1879 (foal by "Champion"); bred by himself; sire, "Cant's Horse"; dam, "Donyland Pride" (190), by "Cupbearer II." (542).

211 Charles Austin, Brandeston Hall, Wickham Market: the *Reserve Number* and *Highly Commended*, for "Darby" (979), chestnut; was foaled in 1875 (foal by "Cupbearer III." (566)); bred by Mr. Jacob Walker, Loudham Hall Farm, Wickham Market; sire, "Royal Duke 2nd" (1366); dam, "Derby" (978), by "Prince" (310).

---

† Given by the Mayor of Norwich, John Gurney, Esq., for the best Suffolk Mare or Filly in Classes 19, 29, 30, 31, and 34.

CLASS 20.—*Agricultural Mare and Foal, not qualified to compete as Shire Clydesdale or Suffolk.**

212 WILLIAM R. TROTTER, South Acomb, Stocksfield-on-Tyne, Northumberland: FIRST PRIZE, 20*l.*, for "Meg Moir," brown; was foaled in 1877 (foal by "Merry Monarch" (538)); breeder unknown.

CLASS 21.—*Hunter Mares and Foals.*

221 ERNEST G. C. BOMFORD, Spring Hill, Pershore, Worcestershire: FIRST PRIZE, 20*l.*, for "Margurite," chestnut; was foaled in 1870 (foal by "Rattle"); bred by Rev. W. Parker, Comberton, Pershore; sire, "Wantage."

223 MAJOR T. HIRST THWAITES, Chevin Grange, Menston, Leeds: SECOND PRIZE, 10*l.*, for "Marion," chestnut; was foaled in 1877 (foal by "Tunis"); sire, "Grandmaster"; dam, "Miss Williams" by "General Williams."

215 ALEXANDER WESTON JARVIS, Middleton Towers, King's Lynn: THIRD PRIZE, 5*l.*, for "Fairy Queen," chestnut; was foaled about 1874 (foal by "Little Jim"); breeder unknown; sire, "Theobald"; dam by "Seabreeze."

218 JOHN FABLING, Fotheringay, Oundle, Northamptonshire: the *Reserve Number* for "Ladybird," black; was foaled in 1872 (foal by "Quits"); breeder unknown; sire, "Oxford."

CLASS 22.—*Hackney Mares and Foals, above* 14 *hands* 2 *inches.*

225 HENRY MOORE, Burn Butts, Cranswick, Hull, Yorkshire: FIRST PRIZE, 15*l.*, for "Princess" (289), chestnut; was foaled in 1879 (foal by "Lord Derby 2nd" (417); bred by himself; sire, "Denmark" (177); dam, "Empress" (95), by "Fireaway" (249).

233 EDWARD B. HAMOND, Waterdem, South Creake, Norfolk: SECOND PRIZE 10*l.*, for "Constance" (63), chestnut; was foaled in 1882 (foal by "Confidence" (158)); dam, "Lady Jane" (198), by "Hurdle;" and THIRD PRIZE, 5*l.*,* for (232) "Jessie" (152), brown; was foaled in 1883 (foal by "Lord Derby" (417)); sire, "Confidence" (158); dam, "Lady Jane" (198), by "Hurdle;" both bred by himself.

229 THE DUKE OF HAMILTON AND BRANDON, K.T., of Easton Park, Wickham Market: the *Reserve Number* and *Highly Commended* for "Duchess," black; age and breeder unknown (foal by "Prickwillow").

CLASS 23.—*Hackney Mares and Foals, above* 13 *hands* 2 *inches, and not exceeding* 14 *hands* 2 *inches.*

247 WOMACK BRANFORD, Godwick, Swaffham, Norfolk: FIRST PRIZE, 15*l.*, for "Alice 2nd" (6), bay; was foaled in 1874 (foal by "Canvasser" (114)); bred by Mr. Edgar Branford, Snape, Wickham Market, Suffolk; sire, "Washington" (852); dam, "Alice," by "Shales."

239 LIEUT.-COL. T. HOLME PARKER, Warwick Hall, Carlisle: SECOND PRIZE, 10*l.*, for "Nelly Bligh," bay, aged (foal by "Sir George" (778)); bred by Mr. Henry Persse, Glenarde, Co. Galway; sire, "Thomastown."

245 CHARLES EARSHAM COOKE, Litcham, Swaffham, Norfolk: THIRD PRIZE, 5*l.*,* for "Snowdrop" (320), grey; was foaled in 1870 (foal by "Canvasser" (114)); breeder unknown.

241 WASHINGTON HAMOND, Pensthorpe, Fakenham, Norfolk; the *Reserve Number* for "Jenny," grey; was foaled in 1881 (foal by "Great Shot" (329)); bred by Mr. John Mann, Hempton, Norfolk; sire, "Hurdle 3rd" (382).

CLASS 24—*Pony Mares and Foals, not exceeding* 13 *hands* 2 *inches.* *

250 ALFRED E. W. DARBY, Little Ness, Shrewsbury; FIRST PRIZE, 15*l.*, for "Wilcot," chestnut; was foaled in 1874 (foal by "Almanza"); bred by Dr. Parry, Caersws, Montgomeryshire; dam, by "Alonzo the Brave."

249 HENRY J. W. HUNTER, King Row Farm, Ovington, Watton, Norfolk: the *Reserve Number* for "Fanny," chestnut; was foaled in 1879 (foal by "Young Fireaway" (267)); breeder unknown.

CLASS 25.—*Shire Fillies foaled in the Year* 1883.

252 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan, Carnarvonshire: FIRST PRIZE, 15*l.*, and *Reserve Number* for Champion Prize for "Gladys," bay; bred by Messrs. Waring Bros., Old House Farm, Catforth, Preston; sire, "What's Wanted"; dam, "Smiler," by "Honest Tom."

256 THE HON. E. K. W. COKE, Longford, Derbyshire: SECOND PRIZE, 10*l.*, for "Comet," bay; bred by Mr. R. C. Palmer, Lodge Farm, Nazing, Waltham Cross, Essex; sire, "Spark" (2497); dam, "Depper."

257 THOMAS HORROCKS MILLER, Singleton Park, Poulton-le-Fylde, Lancashire: THIRD PRIZE, 5*l.*, for "Matilda," grey; bred by Mrs. Rolfe; sire, "Lincolnshire Tom"; dam, "Gipsy" by "Thumper" (2136).

251 EARL SPENCER, K.G., Althorp, Northamptonshire, the *Reserve Number* and *Highly Commended* for "Countess," brown; bred by Mr. Thomas Lowndes, Castern Hall, Ashbourne, Derbyshire; sire, "Premier" (2646); dam, "Madam" by "Sweet William" (2093).

CLASS 26.—*Shire Fillies, foaled in the Year* 1884.

264 THE EARL OF ELLESMERE, Ferry Hill Farm, Chatteris: FIRST PRIZE, 15*l.*, for "Blackpool," black, bred by Mr. Peter Blundell, Kirkham, Lancashire; sire, "Bar None" (2388); dam, "Black Depper of Sir Colin" (2022).

265 ALFRED HENRY CLARK, Moulton Eaugate, Spalding, Lincolnshire: SECOND PRIZE, 10*l.*, for "Empress," grey; bred by Mr. J. C. Allen, Cole Green House, Hertford; sire, "Thumper" (2136); dam, "Judy" by "Napoleon" (1604).

262 WALTER GILBEY, Elsenham Hall, Essex: THIRD PRIZE, 5*l.*, for "Shire Style," black; bred by Mr. John Pearson, Nateby, Garstang, Lancashire; sire, "Lincoln" (1350); dam, "Jewel" by "Matchless" (3862).

263 THE EARL OF ELLESMERE, Ferry Hill Farm, Chatteris: the *Reserve Number* and *Highly Commended* for "Waterfall," black; bred by himself; sire, "Ambassador" (3428); dam, "Watercress" by "Hydraulic" (1130).

CLASS 27.—*Clydesdale Fillies foaled in the Year* 1883.

271 DAVID RIDDELL, Blackhall, Paisley, Renfrewshire: FIRST PRIZE, 15*l.*, for his bay; bred by Mr. James Gourlie, West Farm, Tollcross, Glasgow; sire, "Darnley;" dam, by "Springfield Laddie."

272 The Duke of Portland, Welbeck, Worksop, Nottinghamshire: Second Prize, 10*l.*, for "Loyalty," bay; bred by Mr. James Park, Dechmont, Cambuslang, N.B.; sire, "Lord Erskine" (1744); dam, "The Twin" (625), by "Prince of Wales" (673).

267 Arthur Pease, Hummersknott, Darlington, Co. Durham: Third Prize, 5*l.*, for "Kate," bay; bred by Mr. R. Stewart, Culgriff, Castle Douglas, N.B.; sire, "Manfred."

270 The Marquess of Londonderry, Seaham Hall, Seaham Harbour, Co. Durham: the *Reserve Number* for "Gracie," bay; bred by himself; sire, "Darnley" (222); dam, "Gaiety" (2477), by "What Care I" (912).

Class 28.—*Clydesdale Fillies foaled in the Year* 1884.

280 The Earl of Cawdor, Stackpole Court, Pembroke: First Prize, 15*l.*, for "Dewdrop," bay; bred by Mr. James Kilpatrick, Craigie Mains, Craigie, Ayrshire; sire, "Prince of Wales" (673); dam, "Grace Darling" (2434), by "Lord Lyon" (489).

283 The Duke of Portland, Welbeck, Workshop: Second Prize, 10*l.*, for "Dagmar," bay; bred by Mr. James Drew, Nether Barr, Newton-Stewart, N.B.; sire, "Macgregor" (1487); dam, "Dorothy" (734), by "Disraeli" (234).

275 The Marquess of Londonderry, Seaham Hall, Seaham Harbour, Co. Durham: Third Prize, 5*l.*, for "Stella," brown; bred by himself; sire, "Morning Time" (3849); dam, "Star" (3739), by "What Care I" (912).

281 Richard B. Brockbank, Crosby, Maryport, Cumberland: the *Reserve Number* for "Jewel," bay; bred by John Wright, Park Head, Silloth; sire, "Challenger" (1088); dam, "Bet" (4287), by "Simon Pure" (769).

Class 29.—*Suffolk Fillies foaled in the Year* 1883.

294 The Marquess of Bristol, Ickworth Park, Bury St. Edmunds: First Prize, 15*l.*, and *Reserve Number* for Champion Prize for his chestnut; bred by himself; sire, "Ross" (743); dam, "Brag."

292 Alfred J. Smith, Rendlesham, Woodbridge, Suffolk: Second Prize, 10*l.*, for "Charsfield Lass" (1558), chestnut; bred by Mr. J. Youngman, Charsfield, Woodbridge: sire, "Field Marshal" (1106); dam, "Depper" (1125), by "Royal Duke" (1279).

296 Charles Austin, Brandeston Hall, Wickham Market, Suffolk: Third Prize, 5*l.*, for "Queen of Diamonds," chestnut; bred by Mr. T. Hayward, Ringshall Hall Farm, Stowmarket; sire, "Vanguard" (1327); dam, "Depper," by "Emperor" (618).

295 Robert Capon, Dennington Lodge, Framlingham, Suffolk: the *Reserve Number* and *Highly Commended* for "Empress," chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "Fly" (178), by "Emperor" (644).

Class 30.—*Suffolk Fillies foaled in the Year* 1884.

298 Samuel Wolton, Butley Abbey, Wickham Market, Suffolk: First Prize, 15*l.*, for "Snowdrop" (1405), chestnut; bred by himself; sire, "Chieftain" (1354); dam, "Blyth 2nd" (1073), by "Monarch" (1348).

308 Manfred Biddell, Playford, Ipswich: Second Prize, 10*l.*, for "Stately" (1212), chestnut; bred by Mr. G. D. Clover, Nedging, Bildeston, Suffolk; sire, "Leiston" (1415); dam, "Depper" (1130), by "Cupbearer" (565).

307 Robert Capon, Dennington Lodge, Framlingham, Suffolk: Third Prize, 5*l.*, for "Blossom," chestnut; bred by himself; sire, "Cupbearer III." (566); dam, "Fly" (178), by "Emperor" (644).

300 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market: the *Reserve Number* and *Highly Commended* for "Vixen," chestnut; bred by the Duchess of Hamilton, The Pound, Great Glemham, Saxmundham; sire, "The Wanderer;" dam, "Gyp."

Class 31.—*Suffolk Fillies foaled in the Year* 1885.†

311 Samuel Wolton, Butley Abbey, Wickham Market, Suffolk: First Prize, 15*l.*, for "Virtue" (1767), chestnut; bred by himself; sire, "Chieftain" (1354); dam, "Foxhall Victory" (1080), by "Magnum Bonum" (1347).

315 Robert Henry Wrinch, Harkstead, Ipswich: Second Prize, 10*l.*, for "Clumsy" (1788), chestnut; bred by himself; sire, "Butterfly" (1457); dam, "Ruby" (739), by "Cupbearer II." (542).

318 Robert Edgar, Knight's Hill, Cockfield, Sudbury, Suffolk: Third Prize, 5*l.*, for "Ruby" (1752), chestnut; bred by himself; sire, "Leiston" (1415); dam, "Darby," by "Seckford" (484).

314 Horace Wolton, Newbourn Hall, Woodbridge, Suffolk: the *Reserve Number* and *Highly Commended* for "Pride 3rd" (1746), chestnut; bred by himself; sire, "Diadem" (1553); dam, "Pride 2nd" (1379), by "Cupbearer III." (566).

Class 32.—*Agricultural Fillies not qualified to compete as Shire, Clydesdale or Suffolk, foaled in the Year* 1883.*

322 Lord Hastings, Melton Constable, East Dereham, Norfolk: First Prize, 15*l.*, for "Charity," brown; bred by himself; sire, "Samson II."; dam, "Cheerly."

Class 33.—*Shire Mares foaled previously to the Year* 1883, *not having a foal at foot.**

323 H.R.H. The Prince of Wales, K.G., Sandringham: First Prize, 20*l.*, and Champion Prize, 25*l.*,‡ for "Jewel," black; was foaled in 1879; bred by Mr. W. Lawrenson, Preesall, Garstang; sire, "Sir Colin;" dam, by "Ploughboy."

328 Walter Gilbey, Elsenham Hall, Essex: Second Prize, 10*l.*, for "Chocolate," brown; was foaled in 1879; bred by Mr. T. Appleby, Ashbourne, Derbyshire; sire, "Birkland" (133); dam, by "Waxwork" (2306).

329 The Hon. E. K. W. Coke, Longford, Derbyshire: Third Prize, 5*l.*, for "Czarina," chestnut; was foaled in 1881; bred by Mr. E. M. Williams, Blakesley, Towcester; sire, "Helmden Emperor" (2799); dam, by "England's Glory" (745).

---

† Given by the Suffolk Agricultural Association.

‡ Given by the Mayor of Norwich, John Gurney, Esq., for the best Shire-mare or Filly in Classes 17, 25, 26, and 33.

327 WILLIAM WELCHER, Griston Hall, Watton, Norfolk: the *Reserve Number* and *Highly Commended* for "Griston Brown," brown; was foaled in 1873; bred by himself; sire, "Royal Albert" (1844); dam, "Brisk," by "Sampson" (1932).

CLASS 34.—*Suffolk Mares foaled previously to the Year* 1883, *not having a foal at foot.*†

330 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: FIRST PRIZE, 20*l.*, for "Pride," chestnut; was foaled in 1881; bred by Mr. Alfred Preston, The Grove, Worlingworth; sire, "Cupbearer III." (566); dam, "Matchett" (728), by "Prince" (1141).

336 MANFRED BIDDELL, Playford, Ipswich: SECOND PRIZE, 10*l.*, for "Mistake 3rd" (71), chestnut; was foaled in 1876; bred by himself; sire, "Champion" (130); dam, "Mistake 2nd," by "Prince" (409): and THIRD PRIZE, 5*l.*, for "Blossom" (58), chestnut; was foaled in 1875; bred by Mr. Easter, Beccles, Suffolk; sire, "Young Champion" (1262); dam, "Bunny," by "Dunwich" (73).

331 DANIEL ABBOTT GREEN, East Donyland, Colchester, Essex: the *Reserve Number* for his chestnut; was foaled in 1879; bred by the Executors of the late Mr. B. Page, West House, Fingrinhoe, Colchester; sire, "Prince" (246); dam, "Matchett."

CLASS 35.—*Draught Gelding, any breed foaled in the year* 1882.*

339 JAMES BRADSHAW STEPHENS, Newbottle Farm, Banbury, Oxfordshire: FIRST PRIZE, 15*l.*, for "Captain," grey; bred by Mr. J. Harbidge, Warwickshire.

337 ROBERT MAKENS, Ringshall, Stowmarket, Suffolk: SECOND PRIZE, 10*l.*, for "Boxer," chestnut; bred by himself.

338 JOSEPH GEORGE CALTHORP, Spalding, Lincolnshire: the *Reserve Number* for "Champion," bay; bred by himself; sire, "Boro' Champion" (2537).

CLASS 36.—*Hunter Mare or Gelding, up to* 15 *stone, foaled previously to the Year* 1882.‡

352 JAMES V. KEEVIL, Shaw Farm, Melksham, Wiltshire: FIRST PRIZE, 30*l.*, for "Norseman," bay gelding; was foaled in 1880; breeder unknown.

353 JOHN PALLISTER, Everton, Sandy, Bedfordshire: SECOND PRIZE, 15*l.*, for "Brancepeth," bay gelding; was foaled in 1880; bred by Lord Boyne, Durham; sire, "Argyle."

343 ALGERNON C. FOUNTAINE, Narford Hall, Swaffham, Norfolk: THIRD PRIZE, 10*l.*, for his grey gelding; was foaled in 1880; breeder unknown.

348 JOHN GROUT, Woodbridge, Suffolk: the *Reserve Number* for "Musket," bay gelding; was foaled in 1881; breeder unknown; sire, "Musketeer."

CLASS 37.—*Hunter Mare or Gelding, up to* 12 *stone, foaled previously to the Year* 1882.‡

354 JOHN RUTHERFORD, Summer Hill, Annan, Dumfriesshire: FIRST PRIZE, 30*l.*, for "Shamrock," bay gelding; was foaled in 1876; bred by Mr. W. Spaight, Derry Castle, Killaloe, co. Clare; sire, "Lord Ronald."

† Given by the Suffolk Agricultural Association.

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

362 Andrew John Brown, North Elmsall Hall, Pontefract, Yorkshire: Second Prize, 15*l.*, for "Woodcock," bay gelding; was foaled in 1881; bred by Mr. O'Tool, Wexford; sire, "Æronaut;" dam, by "Gamekeeper."

363 The Earl of Shrewsbury and Talbot, Ingestre, Stafford: Third Prize, 10*l.*, for "Red Duke," bay gelding, aged; sire, "Vauban."

357 William Goodwyn, Marham Hall, Downham Market, Norfolk: the *Reserve Number* for "Certainty," bay mare; was foaled in 1881; bred by Mr. Henry Hoff, Wormegay, King's Lynn; sire "Little Jim."

Class 38.—*Hunter Geldings foaled in the Year* 1882.‡

375 Fred William Burdock, South Elmsall, Doncaster: First Prize, 30*l.*, for "The Czar," brown; breeder unknown; sire, "Boreas."

383 Joseph Trueman Mills, Clermont, Watton, Norfolk: Second Prize, 15*l.*, for "Red Deer," bay; bred by himself; sire, "Arbitrator."

379 Colonel Barlow, Hasketon, Woodbridge, Suffolk: Third Prize, 10*l.*, for "Kildare," bay; bred by Mr. W. Cusson, Little Edstone, Kirby Moorside, Yorks.; sire, "Emperor;" dam by "Cawston."

368 John Lett, Scampston, Rillington, Yorkshire: the *Reserve Number* for "The Critic," chestnut; bred by Mr. T. Carr, Ombersley, Worcester; sire, "Bustard;" dam by "Ancient Briton."

Class 39.—*Hunter Mares foaled in the Year* 1882.‡

386 John Lett, Scampston, Rillington: First Prize, 25*l.*, for "Fascination," chestnut; bred by Mr. W. J. Nelson, Acomb, York; sire, "Meteor;" "dam by Schuloff."

384 Joseph Trueman Mills, Clermont, Watton, Norfolk: Second Prize, 15*l.*, for his bay or brown; bred by himself; sire, "Arbitrator;" dam by "Douro."

388 John Charles Dawson, Nacton, Ipswich, Suffolk: Third Prize, 5*l.*, for his chestnut; bred by himself; sire, "Maximilian;" dam by "William the Conqueror."

387 William Goodwyn, Marham Abbey, Downham Market, Norfolk: the *Reserve Number* for "Curaçoa," chestnut; bred by himself; sire, "Little Jim;" dam "Cayenne," by "Chit Chat."

Class 40.—*Hunter Geldings foaled in the Year* 1883.‡

393 Dr. Edmund Waller, R.N., Broad Bridge Street, Peterborough, Northamptonshire: First Prize, 15*l.*, for "The Masher," chestnut; bred by himself; sire, "The Muleteer;" dam "Flash," by "Little Jim."

396 Andrew John Brown, North Elmsall Hall, Pontefract, Yorkshire: Second Prize, 10*l.*, for "Amber," brown; bred by Mr. Wedger, Waterford; sire, "Ambergris;" dam by "East Coast."

392 Richard Percival, Burgh-by-Sands, Carlisle, Cumberland: the *Reserve Number* for "Harmonium," chestnut; bred by himself; sire, "Golden Horn;" dam "Ruby," by "Laughingstock."

---

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

Class 41.—*Hunter Fillies, likely to become weight carriers, foaled in the Year* 1883.

400 Frederick Blenkin, Old Hall, Burstwick, Hull, Yorkshire: First Prize, 15*l.*, for "Princess Beatrice," chestnut; bred by himself; sire, "Bay President;" dam by "Theobald."

399 George Coates Whitwell, Stockton-on-Tees, co. Durham: Second Prize, 10*l.*, for "Countess," bay; bred by himself; sire, "Claremont;" dam "Maggie," by "Goblin."

398 Joseph Critchley Martin, Narborough Hall, Swaffham, Norfolk: the *Reserve Number* for "Pauline," brown; bred by himself; sire, "Little Jim;" dam "Polly."

Class 42.—*Hunter Fillies, likely to become weight carriers, foaled in the Year* 1884.

403 Charles Cooper Hayward, Southill, Biggleswade, Bedfordshire: First Prize, 15*l.*, for "Pantheon," bay or brown; bred by Mr. Francis Coates, Chicherly, Bedfordshire; sire, "Pedometer;" dam "Duchess," by "Mulatto."

402 David Christy, Patching Hall, Chelmsford, Essex: Second Prize, 10*l.*, for "Brunette," brown; bred by himself; sire, "Humphrey Clinker;" dam by "Achilles."

405 Professor Branford, 22, Clarence Street, Edinburgh: the *Reserve Number* for his chestnut; bred by the Duchess of Montrose; sire, "Sefton;" dam "Highland Lassie," by "Stockwell" or "Caterer."

Class 43.—*Harness Mares or Geldings, exceeding* 15 *hands.*‡

417 John Robinson, Cleavland House, Coltman Street, Hull: First Prize, 15*l.*, for "Lady Shrewsbury," black mare; was foaled in 1879; bred by Mr. W. Percy, Tibthorpe Wold, Driffield; sire, "Duke of Connaught;" dam by "Sir Charles:" and Second Prize, 10*l.*, for (418) "Lady Julia," black mare; was foaled in 1879; bred by Mr. Leake, Kettledrum Farm, Cave, Brough; sire, "Lord Derby 2nd;" dam by "Denmark."

416 Alfred Rowell, Bury, Huntingdonshire: the *Reserve Number* and *Highly Commended* for "Lord Randolph," bay gelding; was foaled in 1880; bred by himself; sire, "Fireaway;" dam "Lady Lucy," by "The Gentleman."

Class 44.—*Harness Mares or Gelding, exceeding* 14 *hands, and not exceeding* 15 *hands.*‡

431 Henry Frisby, 14, James St., Buckingham Gate, London: First Prize, 15*l.*, for "Movement," skewbald mare; was foaled in 1877; bred by Mr. Cooke, Litcham, Norfolk; sire, "Washington;" dam by "Shepherd F. Knapp."

435 John Grout, Woodbridge, Suffolk: Second Prize, 10*l.*, for "Ruby," brown mare; was foaled in 1881; bred by Mr. F. Childerhouse, Attleborough.

---

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

427 Pascoe William Mickelburgh, Aldeby House, Beccles, Suffolk: the *Reserve Number* and *Highly Commended* for "Arabella," bay mare; was foaled in 1882; bred by himself; sire, "Tom Moody;" dam "Prickwillow Excellent," by "Prickwillow."

Class 45.—*Harness Pony, Mares or Geldings not exceeding* 14 *hands.*‡

437 William Pope, Cannon House, Downham Market, Norfolk: First Prize, 15*l.*, for "Magpie" (228), black and white mare; was foaled in 1878; bred by Mr. E. Cooke, Litcham; sire, "Confidence;" dam by "Premier."

440 George H. K. Francis, Old Hall, Mattishall, Dereham, Norfolk: Second Prize, 10*l.*, for "Lady Beatrice," bay mare; was foaled in 1882; bred by himself; sire, "Congress."

436 James Howell, Little Walsingham, Norfolk: the *Reserve Number* and *Highly Commended* for "Lassie," chestnut mare; was foaled in 1882; bred by himself; sire, "Model;" dam "Kitty," by "Robin Hood."

Class 46.—*Hackney Mares or Geldings not exceeding* 15 *hands* 2 *inches, up to not less than* 15 *stone, foaled previously to the Year* 1883.‡

456 John Robinson, Cleavland House, Coltman Street, Hull: First Prize, 15*l.*, for "Princess," chestnut mare; was foaled in 1880; bred by Mr. A. Fewson, Hedon, Hull; sire, "Lord Derby 2nd."

457 John William Hunn, Hunstanton, King's Lynn: Second Prize, 10*l.*, for "Ladybird 2nd," chestnut mare; was foaled in 1880; bred by himself; sire, "National Guard;" dam "Ladybird," by "Shales."

452 Edward B. Hamond, Waterden, South Creake, Norfolk: Third Prize, 5*l.*, for "Kitty," bay mare; was foaled in 1880; bred by himself; sire, "Confidence" (158); dam "Lady Jane," by "Hurdle."

455 John Grout, Woodbridge, Suffolk: the *Reserve Number* and *Highly Commended* for "Grey-lock," grey; was foaled in 1880; breeder unknown.

Class 47.—*Hackney Mares or Geldings, above* 14 *hands and not exceeding* 15 *hands* 2 *inches, up to not less than* 12 *stone, foaled previously to the Year* 1883.‡

462 Henry Frisby, 14, James Street, Buckingham Gate, London: First Prize, 15*l.*, and *Champion Prize*, 25*l.*,† for "Cardiff," bay gelding; was foaled in 1878; breeder unknown; sire, "Southampton;" dam by "Astonisher."

469 John Robinson, Cleavland House, Coltman Street, Hull: Second Prize, 10*l.*, for "Apology," brown mare; was foaled in 1879; bred by the late Mr. Suddaby, Skipsea, Holderness; sire, "Denmark;" dam by "Theobald."

467 John Grout, Woodbridge, Suffolk: Third Prize, 5*l.*, for "The Baron," bay gelding; was foaled in 1881; breeder unknown.

460 Charles William Blacklock, of Big Bush Farm, Kingsbury, Hendon, Middlesex: the *Reserve Number* and *Highly Commended* for "King of Fashion," bay gelding; was foaled in 1881; breeder unknown.

---

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

† Given by H. Birkbeck, Esq., for the best animal in Classes 46 to 49.

CLASS 48.—*Hackney Fillies foaled in* 1883 *or* 1884.‡

474 HENRY MOORE, Burn Butts, Cranswick, Hull: FIRST PRIZE, 15*l*., and *Reserve Number* for Champion Prize for "Sweetbriar," brown; was foaled in 1883; bred by himself; sire, "Denmark" (177); dam, "Empress" (95), by "Fireaway" (249).

473 MARK PEARSON, Rose Villa, Knaresboro', Yorkshire: SECOND PRIZE, 10*l*., for "Mary Anderson," chestnut; was foaled in 1883; bred by Mr. J. M. Clarkson, Smylett Hall, Pocklington, Yorks; sire, "Denmark;" dam by "Old Performer."

472 ALFRED LEWIS, Heacham, Lynn, Norfolk: THIRD PRIZE, 5*l*., for "Lady Love," chestnut; was foaled in 1883; bred by Mr. Robert Balding, King's Lynn; sire, "Norfolk Jack" (1071); dam by "Great Gun" (323).

477 GEORGE H. K. FRANCIS, Old Hall, Mattishall, Dereham, Norfolk: the *Reserve Number* and *Highly Commended* for "Lady Beaconsfield," chestnut; was foaled in 1883; bred by himself; sire, "Lord Beaconsfield;" dam, "Rosa," by "Sudbury Norfolk Jack."

CLASS 49.—*Pony Mares or Geldings not exceeding* 14 *hands.* ‡

484 WILLIAM CASE, Tuttington, Aylsham, Norfolk: FIRST PRIZE, 15*l*., for "Contention," bay gelding; was foaled in 1881; breeder unknown.

483 HENRY FRISBY, 14, James Street, Buckingham Gate, London: SECOND PRIZE, 10*l*., for "Canary," dun; was foaled in 1876; breeder unknown.

486 HORACE BARRY, JUN., Eagle House, Upper Edmonton, Middlesex: THIRD PRIZE, 5*l*., for "Carthusian," black gelding; was foaled in 1880; breeder unknown; sire, "Sir George."

481 ALFRED LEWIS, Heacham, Lynn, Norfolk: the *Reserve Number* for "Merrylegs" (383), bay mare; was foaled in 1879; bred by Mr. Uriah Wilson, East Wrinch, King's Lynn; sire, "Rifleman;" dam, "Cock o' the Walk."

CATTLE.

CLASS 50.—*Shorthorn Bulls calved in either* 1881 *or* 1882.

495 HENRY WILLIAMS, Moor Park, Harrogate, Yorkshire: FIRST PRIZE, 20*l*., for "Prince of Halnaby," roan; was calved October 24th, 1882; bred by Mr. W. T. Talbot-Crosbie, Ardfert Abbey, Ardfert, Ireland; sire, "King David" (43,417); dam, "Princess of Halnaby," by "Royal Halnaby" (39,041); g. d., "Princess Charlotte," by "Foreign Prince" (36,656); gr. g. d., "Bredina," by "Regal Booth" (27,262); gr. g. g. d., "Royal Brenda," by "Royal Sovereign" (22,802).

496 WILLIAM HANDLEY, Green Head, Milnthorpe, Westmoreland: SECOND PRIZE, 10*l*., for "Hiawatha" (48,027), roan; was calved May 5th, 1882; bred by Mr. James A. Gordon, Arabella, Nigg Station, Ross-shire; sire, "Rob Roy" (45,484); dam, "Heather Bell," by "Rosario" (35,315); g. d., "Flora," by "Baron Killerby" (27,949); gr. g. d., "Flavia," by "Fashion" (21,724); gr. g. g. d., "Lady Elvina," by "Lord Elgin" (20,170).

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

497 Charles R. Breach and Charles W. Coupland, Colehurst, Combe Fields, Rugby, Warwickshire: the *Reserve Number* and *Highly Commended* for "Self Esteem 2nd" (48,675), roan; was calved September 9th, 1881; bred by Sir William C. Worsley, Bart., Hovingham, York; sire, "Hovingham" (43,363); dam, "Trusty Lass," by "Sir Robin" (40,720); g. d., "Conceit," by "Earl of Derby" (21,638); gr. g. d., "Confidence," by "Wizard of Windsor" (21,124); gr. g. g. d., "Trust," by "Sir Charles" (16,949).

Class 51.—*Shorthorn Bulls calved in the Year* 1883.

499 William Handley, Green Head, Milnthorpe: First Prize, 20*l.*, and the Champion Prize, 25*l.*,† for "Royal Ingram" (50,374), red and white; was calved January 6th; bred by himself; sire, "Sir Arthur Ingram" (32,490); dam, "Harmony," by "Sir Arthur Windsor" (35,541); g. d., "Hannah," by "Prince Arthur" (29,597); gr. g. d., "Young White Ammons," by "Sir Walter Trevelyan" (25,179); gr. g. g. d., by "General Garibaldi" (21,813).

501 Charles William Brierley, Rosedale, Tenbury, Worcestershire: Second Prize, 10*l.*, for "Ruckley," white; was calved May 23rd; bred by the late Mr. S. L. Horton, Park House, Shifnal, Salop; sire, "Prince Saturn" (46,926); dam, "Constance Doon," by "Marquis of Blandford 6th" (41,983); g. d., "Lorna Doon," by "Abacot" (32,900); gr. g. d., "Ellie," by "Prince Albert" (18,579); gr. g. g. d., "Rose of Midsummer," by "Sir Colin" (15,276).

498 Robert Thompson, Inglewood, Penrith, Cumberland: the *Reserve Number* for "Mountain Chief 2nd" (50,080), white; was calved March 19th; bred by Mr. E. W. Meade-Waldo, Barmoor Castle, Beal, Northumberland; sire, "King Malcolm" (43,419); dam, "Mountain Dell," by "Waltron" (30,255); g. d., "Mountain Vale," by "Blinkhoolie" (23,428); gr. g. d., "Mountain Mist," by "Booth Royal" (15,673); gr. g. g. d., "Mountain Maid," by "Vanguard" (10,994).

Class 52.—*Shorthorn Bulls calved in the Year* 1884.

506 William Handley, Green Head, Milnthorpe: First Prize, 20*l.*, for "Golden Treasure" (51,346), roan; was calved March 22nd; bred by himself; sire, "Sir Arthur Ingram" (32,490); dam, "Princess Flora," by "Alfred the Great" (36,121); g. d., "Earl's Flora," by "Earl of Eglinton" (23,832); gr. g. d., "Flora Cobham," by "Marquis of Cobham" (22,299); gr. g. g. d., "Flower of Fitz-Clarence," by "Alfred Fitz-Clarence" (19,215).

507 John Fielden, Grimston Park, Tadcaster, Yorkshire: Second Prize, 10*l.*, for "Dryops" (51,089), roan; was calved January 16th; bred by himself; sire, "Heart of Oak" (39,982); dam, "Nymph," by "Janus" (34,245); g. d., "Queen of the Hills," by "Merry Monarch" (22,349); gr. g. d., "Queen of the Glen," by "Valasco" (15,443); gr. g. g. d., "Forest Queen," by "Royal Buck" (10,750).

508 Charles R. Breach and Charles W. Coupland, Colehurst, Combe Fields, Rugby, Warwickshire: Third Prize, 5*l.*, for "Confidence," roan; was calved June 20th; bred by Mr. John T. Story, Hooton Roberts, Rotherham; sire, "Self Esteem 2nd" (48,675); dam, "Cherry Bracelet,"

† Given by the Shorthorn Society for the best male Shorthorn.

by "Ben Brace" (30,524); g. d., "Bracelet," by "Major" (24,513); gr. g. d., "Mirthful," by "Shan O'Neil" (25,120); gr. g. g. d., "Cheerful," by "Warlock" (19,113).

505 JOHN GARNE, Great Rissington, Gloucestershire: the *Reserve Number* and *Highly Commended* for "The Baronet," roan; was calved February 18th; bred by Mr. F. P. Bulley, Marston Hill, Fairford, Gloucestershire; sire, "Sir John Carew 2nd" (47,107); dam, "Venus 8th," by "Duke of Hazlecote 55th" (37,946); g. d., "Venus 7th," by "Chorister" (36,362); gr. g. d., "Venus 6th," by "Lord Stanley" (22,217); gr. g. g. d., "Venus 5th," by "Sarsden Clipper" (20,787).

CLASS 53.—*Shorthorn Bulls, calved in the Year* 1885.

518 WILLIAM HANDLEY, Green Head, Milnthorpe: FIRST PRIZE, 20*l.*, for "Royal Hovingham," roan; was calved January 20th; bred by himself; sire, "Hovingham" (43,363); dam, "Emily," by "Alfred the Great" (36,121); g. d., "Earl's Flower," by "Earl of Derwent" (28,503); gr. g. d., "Annette," by "Prince Arthur" (29,597); gr. g. g. d., "White Ammons," by "Sir Walter Trevelyan" (25,179).

511 ANTHONY METCALFE-GIBSON, Coldbeck, Ravenstonedale, Kirkby Stephen, Westmoreland: SECOND PRIZE, 10*l.*, for "Royal Arthur," roan; was calved March 14th; bred by Mr. William Handley, Greenhead, Milnthorpe, Westmoreland; sire, "Royal Ingram" (50,374); dam, "Derwent Queen 2nd," by "Sir Arthur Ingram" (32,490); g. d., "Derwent Queen," by "Baron Stackhouse" (30,488); gr. g. d., "Derwent Lady 2nd," by "Vice Roi" (30,214); gr. g. g. d., "Derwent Lady," by "The Premier" (27,640).

521 ALEXANDER LAUDERDALE DUNCAN, Knossington Grange, Oakham: THIRD PRIZE, 5*l.*, for "Melton," roan; was calved January 23rd; bred by the late Mr. Edward Pease, The Crundalls, Bewdley, Worcestershire; sire, "Earl of Aylesbury 4th" (46,291); dam, "Park Nellie," by "Foster Brother" (36,661); g. d., "Nellie," by "Chieftain" (20,942); gr. g. d., "Helen," by "Field Marshal" (16,044); gr. g. g. d., "Bessy," by "Apollo" (9,898).

524 CHARLES WILLIAM BRIERLEY, Rosedale, Tenbury, Worcestershire: the *Reserve Number* and *Highly Commended* for "New Year's Gift," red and white; was calved January 4th; bred by Mr. George John Bell, The Nook, Irthington, Carlisle; sire, "Grand Duke Worcester" (46,456); dam, "Early Rose," by "Magician" (34,720); g. d., Ella," by "Keir Butterfly 8th" (28,951); gr. g. d., "Miss Eliza," by "Rifleman" (32,304); gr. g. g. d., "Eliza 2nd," by "Mac Turk" (14,872).

CLASS 54.—*Shorthorn Cows, in-milk or in-calf, calved previously to or in the Year* 1882.

530 TEASDALE HILTON HUTCHINSON, Manor House, Catterick, Yorkshire: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 25*l.*,† for "Lady Pamela," roan, was calved March 17th, 1881; in-milk; calved November, 1885; and in-calf; sire, "British Knight" (33,220); dam, "Lady Pateley," by "Vehement" (33,853); g. d., "Lady Nidderdale," by "Merry Monarch" (22,349); gr. g. d., "Lady Fly," by "Champion" (23,520); gr. g. g. d., "Purity," by "Perfection" (27,049): and SECOND PRIZE, 10*l.*, for (531) "Glad Tidings," roan; was calved December 24th, 1880;

† Given by the Shorthorn Society for the best female Shorthorn.

in-milk; calved July, 1885, and in-calf; sire, "Master of Arts" (34,816); dam, "Gratification," by "M. C." (31,896); g. d., "Gerty 3rd," by "Knight of the Shire" (26,552); gr. g. d., "Gerty," by "Vain Hope" (23,102); gr. g. g. d., "Garland," by "Grand Master" (24,078); both bred by himself.

529 Robert Thompson, Inglewood, Penrith, Cumberland: Third Prize, 5*l.*, for "Inglewood Belle," roan; was calved January 3rd, 1882; in-milk; calved September 14th, 1885, and in-calf; bred by himself; sire, "Beau Benedict" (42,769); dam, "Inglewood Pet," by "Brilliant Butterfly" (36,270); g. d., "Love Token," by "Grand Duke of Fawsley 3rd" (31,286); gr. g. d., "Farewell," by "Royal Westmoreland" (35,416); gr. g. g. d., "General's Daughter," by "General Haynau" (11,520).

528 Washington Hamond, Pensthorpe, Fakenham, Norfolk; the *Reserve Number* and *Commended* for "Pearlfeather 3rd," roan; was calved March 20th, 1875; in-milk; calved April 20th, 1885; bred by Sir Frederick C. Smythe, Bart., Acton Burnell, Shrewsbury; sire, "British Lion" (30,609); dam, "Pearlfeather 2nd," by "Zealot" (25,480); g. d., "Plume," by "Skipper" (20,854); gr. g. d., "Peerless," by "Plato" (18,552); gr. g. g. d., "Pride," by "The Saxon" (12,215).

Class 55.—*Shorthorn Cows or Heifers, in-milk or in-calf, calved in the Year* 1883.

538 Teasdale Hilton Hutchinson, Manor House, Catterick, Yorkshire: First Prize, 20*l.*, for "Lady Golightly," roan; was calved November 28th; in-calf; bred by himself; sire, "Riby Star" (46,983); dam, "Lady Gray," by "British Knight" (33,220); g. d., "Lady Grace," by "K.C.B." (26,492); gr. g. d., "Lady Graceful," by "Knight Errant" (18,154): gr. g. g. d., "Lady of the Manor," by "Baron Warlaby" (7813).

536 William Hosken and Son, Loggans Mill, Hayle, Cornwall: Second Prize, 10*l.*, for "Sylvia 11th," roan; was calved June 20th; in-milk; calved May 4th, 1886; bred by themselves; sire, "Grand Duke of Oxford 5th" (43,318); dam, "Sylvia 5th," by "Second Baron Wild Eyes" (30,497); g. d., "Sylvia," by "Thorndale Mason" (23,067); gr. g. d., "Stately," by "General Pelissier" (14,065); gr. g. g. d., "Songstress," by "Royal" (13,636).

539 Charles William Brierley, Rosedale, Tenbury, Worcestershire: Third Prize, 5*l.*, for "Rosedale Snowflake," roan; was calved January 6th; in-milk; calved January 14th, 1886; bred by himself; sire, "Rosedale Oxford" (48,597); dam, "Snowflake," by "Bolivar's Farewell" (33,173); g. d., "Bolivar's White Tulip," by "Bolivar" (25,649); gr. g. d., "Tulip Flower," by "Lord Albert" (20,143); gr. g. g. d., "Rachel," by "Monarch" (18,412).

535 George Thomas Mackley, Harrowfield, Eltham Road, Lee, Kent: the *Reserve Number* and *Commended* for "Cherry Ripe 13th," red and white, was calved December 27th," in-milk; calved May 2nd, 1886; bred by himself; sire, "Earl" (42,322); dam, "Cherry Ripe 12th," by "The Friar" (35,766); g.d., "Cherry Ripe 1st," by "Sweet William 2nd" (27,590); gr. g. d. "Cherry Royal," by "Knightley Grand Duke" (24,268); gr. g. g. d., "Cherry Blossom," by "Duke of Cambridge" (21,574).

Class 56.—*Shorthorn Heifers calved in the Year* 1884.

540 The Rev. Robert Bruce Kennard, Marnhull Rectory, Blandford, Dorset: First Prize, 20*l*., for "Queen of the Isles," red and little white; was calved April 14th; bred by himself; sire, "Montrose" (45,261); dam, "Queen of the Glebe," by "Lord Fitzclarence 24th" (40,163), g. d., "Queen Victoria," by "Marquis of Blandford 4th" (38,712); gr. g. d., "Queen Mary," by "Grand Duke of Oxford" (28,763); gr. g. g. d., "Queen Anne," by "Lord Stanley 2nd" (26,745).

541 William Hosken and Son, Loggans Mill, Hayle, Cornwall: Second Prize, 10*l*., for "Alexandria 9th," roan; was calved January 2nd; bred by themselves; sire, "Grand Duke of Oxford 5th" (43,318); dam, "Alexandria 5th," by "Prince of Oxford" (42,212); g. d., "Alexandria," by "Second Earl of Oxford" (23,844); gr. g. d., "Maid of Athens," by "Sir Richard" (15,298); gr. g. g. d., "Miss Bloomer," by "Siddington Duke" (15,263).

544 Teasdale Hilton Hutchinson, Manor House, Catterick, Yorkshire: Third Prize, 5*l*., for "Victoria Formosa," roan; was calved May 6th; bred by himself; sire, "Riby Star" (46,983); dam, "Victoria Frigida," by "Janus" (34,245) or "Heart of Oak" (39,982); g. d., "Victoria Candida," by "Royal Commander" (29,857); gr. g. d., "Victoria Septima," by "Bythis" (25,700); gr. g. g. d., "Victoria Quinta," by "Ravenshope" (22,681).

543 Robert Thompson, Inglewood, Penrith, Cumberland: the *Reserve Number* and *Highly Commended* for "Molly Millicent," roan; was calved June 11th; bred by himself; sire, "Beau Benedict" (42,769); dam, "Fair Millicent 2nd," by "Brilliant Butterfly" (36,270); g. d., "Fair Millicent," by "Grand Duke of Fawsley 3rd" (31,286); gr. g. d., "Moss Rose 4th," by "Royal Gwynne" (22,784); gr. g. g. d., "Moss Rose," by "Lord of Brawith" (10,465).

Class 57.—*Shorthorn Heifers calved in the Year* 1885.

572 David Pugh, Manoravon, Llandilo, Carmarthenshire: First Prize, 20*l*., for "Zoe 5th" roan; was calved June 18th; bred by himself; sire, "Sir Charles" (44,020); dam, "White Zoe," by "Falmouth" (38,268); g. d., "Zoe," by "Marquis 1st (34,774); gr. g. d., "Czarina 10th," by "Duke of Albemarle" (28,355); gr. g. g. d., "Czarina 9th," by "Falconer" (23,907).

570 Thomas Chalk, Linton, Cambridgeshire: Second Prize, 10*l*., for "Ballad," red and white, was calved August 23rd; bred by himself; sire, "Self Esteem 2nd" (48,675); dam, "Melody," by "Babraham Duke" (40,996); g. d., "Vocalist," by "Young England" (31,110); gr. g. d., "Warbler," by "Sinbad" (29,981); gr. g. g. d., "Songstress," by "Grand Duke 16th" (24,063).

574 William Henry Wakefield, Sedgwick House, Kendal, Westmoreland: Third Prize, 5*l*., for "Welcome 10th," roan; was calved January 7th; bred by himself; sire, "Dentsman" (51,071); dam, "Welcome 6th," by "Duke of Holker" (38,153); g. d., "Welcome 2nd," by "Baron Barrington 4th" (33,006); gr. g. d., "Welcome," by "Dunrobin" (28,486); gr. g. g. d., "Banks 3rd," by "Frederick Warlaby" (23,990).

557 The Duke of Northumberland, Alnwick Castle: the *Reserve Number* and *Highly Commended* for "Bridal Guest," roan; was calved January 13th; bred by himself; sire, "King David" (43,417); dam, "Bridal Wreath," by "Fitz-Roland" (33,936); g. d., "Bridesmaid," by "Ace of

Trumps" (30,355); gr. g. d., "Dewdrop," by "President" (20,510); gr. g. g. d., "Maid of Aln," by "Melsonby" (18,380).

Class 58.—*Hereford Bulls calved in either* 1881 *or* 1882.

578 The Earl of Coventry, Croome Court, Severn Stoke, Worcestershire: First Prize, 20*l.*, for "Good Boy" (7668); was calved November 28th, 1881; bred by himself; sire, "Fisherman" (5913); dam, "Giantess," by "Sir Roger" (4133); g. d., "Haidee," by "Battenhall" (2406); gr. g. d., "Diana," by "Carbonel" (1525); gr. g. g. d., "Y. Dainty," by "Doctor" (1083).

577 William Tudge, Leinthall, Ludlow: Second Prize, 10*l.*; was calved October 20th, 1881; bred by himself; sire, "Westonbury" (6254); dam, "Roseleaf," by "Lord Hythe" (3937); g. d., "Rosebud," by "Sir Thomas" (2228); gr. g. d., "Rose," by "North Star" (2138); gr. g. g. d., "Rose," by "The Grove" (1764).

Class 59.—*Hereford Bulls calved in the Year* 1883.

584 Henry William Taylor, Showle Court, Ledbury, Herefordshire: First Prize, 20*l.*, for "Maidstone" (8875); was calved April 20th; bred by himself; sire, "Franklin" (6961); dam, "Duchess 4th," by "Tredegar" (5077); g. d., "Duchess," by "Twin" (2284); gr. g. d., "Duchess," by "Alma" (1144); gr. g. g. d., "Victoria," by "Prince Albert" (686).

587 Henry Haywood, Blakemere House, Hereford: Second Prize, 10*l.*, for "Honeywood" (8741), was calved April 11th; bred by himself; sire, "Truro" (5677); dam, "Hopbine 7th," by "Blakemere" (5227); g. d., "Hopbine 2nd," by "Sir Samuel" (4136); gr. g. d., "Hopbine," by "Cholstrey" (1918); gr. g. g. d., "Hewer 2nd," by "Blakemere" (1151).

586 Richard Edwards, Combe Farm, Presteign, Radnorshire: Third Prize, 5*l.*, for "Magnet" (8873); was calved July 7th; bred by himself; sire, "Marquis" (6057); dam, "Broken Horn," by "Commander" (4452); g. d. "Old Broken Horn," by "Governor" (3137); gr. g. d., "Peach," by "Pollox" (2163); gr. g. g. d., "Peach," by "Pilot" (1036).

583 Henry William Taylor, Showle Court: the *Reserve Number* and *Highly Commended* for "Crown Prince" (8464); was calved June 2nd; bred by himself: sire, "Franklin" (6961); dam, "Modesty," by "Tredegar" (5077); g. d., "Lovely," by "Tenant Farmer" (2806); gr. g. d., "Browney," by "Twin" (2284).

Class 60.—*Hereford Bulls calved in the Year* 1884.

594 The Earl of Coventry, Croome Court, Worcestershire: First Prize, 20*l.*, for "Rare Sovereign" (10,499); was calved February 19th; bred by himself; sire, "Good Boy" (7668); dam, "Rare Jewel," by "Merry Monarch" (5466); g. d., "Rarity 14th," by "Archduke" (4312); gr. g. d., "Rarity 3rd," by "Silver Prince" (5583); gr. g. g. d., "Rarity," by "Conqueror" (1929).

596 George Child, Court of Noke, Pembridge, Herefordshire: Second Prize, 10*l.*, for "Warrior True;" was calved March 6th; bred by Mr. S. H. Atkinson, Letton Court, Letton; sire, "Whitfield" (5692); dam, "Bertha," by "Treasure Trove" (5074); g. d. "Bounty 2nd," by "Cholstrey" (1918); gr. g. d., "Bounty," by "Albert Edward" (859); gr. g. g. d., "Bounty," by "Abbingham" (911).

590 WILLIAM TUDGE, Leinthall, Ludlow: THIRD PRIZE, 5*l.*, for "Trojan" (10,742); was calved April 10th; bred by himself; sire, "Auctioneer" (5194); dam, "Rustic Beauty," by "Napoleon" (5476); g. d. "Rustic," by "Milton 4th" (6575); gr. g. d., "Rosebud," by "Red Lake" (4075); gr. g. g. d., "Roseblossom," by "Defence" (3062).

591 HENRY WILLIAM TAYLOR, Showle Court, Ledbury, Herefordshire: the *Reserve Number* for "Livingstone" (10,184); was calved November 29th; bred by himself; sire, "Franklin" (6961); dam, "Fairy," by "Thoughtful" (5063); g. d., "Hazel," by "Tom Brown" (2828); gr. g. d., "Hazel," by "Holmer" (2043); gr. g. g. d., "Hazel," by "Showle" (1384).

CLASS 61.—*Hereford Bulls calved in the Year* 1885.

602 REES KEENE, Pencraig, Caerleon, Monmouthshire: FIRST PRIZE, 20*l.*, for "Reliance;" was calved March 4th; bred by himself; sire, "Bangham" (6793); dam, "Water Daisy," by "Lord Waterford" (6045); g. d., "Daisy 4th," by "Arrow" (3661); gr. g. d., "Young Daisy," by "Prince Arthur" (2695); gr. g. g. d., "Daisy," by "Pencraig" (2671).

599 JAMES RANKIN, Bryngwyn, Tram Inn, Herefordshire: SECOND PRIZE, 10*l.*, for "Cicero;" was calved February 1st; bred by himself; sire, "Lord Wilton" (4740); dam, "Columbine 3rd," by "Remus" (5535); g. d., "Columbine," by "Albert" (2921).

600 JOHN PRICE, Court House, Pembridge, Herefordshire: THIRD PRIZE, 5*l.*, for "Plato;" was calved March 17th; bred by himself; sire, "Monarch" (7858); dam, "Plum 5th," by "Grand Duke" (5342); g. d., "Plum," by "Horace" (3877); gr. g. d., "Plum," by "North Star" (2138); gr. g. g. d., "Plum," by "Havelock" (1609).

609 RICHARD GREEN, The Whittern, Kington, Herefordshire: the *Reserve Number* and *Highly Commended* for "Whittern Prince;" was calved March 21st; bred by himself; sire, "Lord Wilton" (4740); dam, "Perfection," by "Rodney" (4907); g. d., "Charity 2nd," by "Longhorns" (4711); gr. g. d., "Charity," by "Heart of Oak" (2035); gr. g. g. d., "Luna," by "Counsellor" (1939).

CLASS 62.—*Hereford Cows, in-milk or in-calf, calved previously to or in the Year* 1882.

624 THE EARL OF COVENTRY, Croome Court, Severn Stoke, Worcestershire: FIRST PRIZE, 20*l.*, for "Golden Treasure;" was calved May 25th, 1878; in-milk; calved January 7th, 1886, and in-calf; bred by himself; sire, "Maréchal Niel" (4760); dam, "Giantess," by "Sir Roger" (4133); g. d., "Haidee," by "Battenhall" (2406); gr. g. d., "Diana," by "Carbonel" (1525); gr. g. g. d., "Y. Dainty," by "Doctor" (1083).

621 ALLEN EDWARDS HUGHES, Wintercott, Leominster, Herefordshire: SECOND PRIZE, 10*l.*, for "Sunflower;" was calved April 23rd, 1882; in-milk; calved September 25th, 1885; bred by himself; sire, "Commander" (4452); dam, "Spangle 4th," by "Royalist" (4921); g. d., "Sonnet," by "Leominster 3rd" (3211); gr. g. d., "Silk," by "Comet" (2469); gr. g. g. d., "Silva," by "Adforton" (1839).

618 WILLIAM TUDGE, Leinthall, Ludlow: THIRD PRIZE, 5*l.*, for "Rebe;" was calved April 25th, 1879; in-calf; bred by himself; sire, "Napoleon" (5476); dam, "Rebecca," by "Cannon Ball" (4399); g. d., "Red Star," by "Red Lake" (4075); gr. g. d., "Patch," by "Defence" (3062); gr. g. g. d., "Patty," by "Plato" (2161).

620 Frederick James Gough, Bordesley Hall, Redditch: the *Reserve Number* and *Highly Commended* for "Mabelle;" was calved July 18th, 1881; in-milk; calved August 13th, 1885; bred by the late Mr. T. J. Carwardine, Stockton Bury, Leominster; sire, "Lord Wilton" (4740); dam, "Charity 2nd," by "Longhorns" (4711); g. d., "Charity," by "Heart of Oak" (2035); gr. g. d., "Luna," by "Counsellor" (1939); gr. g. g. d., "Picture," by "Sir Thomas" (2228).

Class 63.—*Hereford Cows or Heifers, in-milk or in-calf, calved in the Year* 1883.

625 Arthur P. Turner, The Leen, Pembridge, Herefordshire: First Prize, 20*l.*, for "Kathleen;" was calved March 8th; in-milk; calved February 23rd, 1886; bred by himself; sire, "The Grove 3rd" (5051); dam, "Helena," by "Corsair" (5271); g. d., "Elfrida," by "Prince Arthur" (3345); gr. g. d., "Ella," by "Bachelor" (2941); gr. g. g. d., "Rosamond," by "Demetrius" (2494).

626 Henry William Taylor, Showle Court, Ledbury, Herefordshire: Second Prize, 10*l.*, for "Vanity 7th;" was calved February 17th; in-calf; bred by himself; sire, "Franklin" (6961); dam, "Vanity 4th," by "Adamant" (5710); g. d., "Vanity," by "Troublesome" (5086); gr. g. d., "Fanny," by "Triumph" (2836); gr. g. g. d., "Silk," by "Twin" (2284).

Class 64.—*Hereford Heifers calved in the Year* 1884.

630 Henry William Taylor, Showle Court; First Prize, 20*l.*, for "Auricula;" was calved September 18th; bred by himself; sire, "Franklin" (6961); dam, "Grand Duchess," by "Adamant" (5710); g. d., "Empress," by "Tredegar" (5077); gr. g. d., "Young Beauty," by "Sir Francis" (3438); gr. g. g. d., "Beauty," by "Holmer" (2043).

632 John Richard Hill, Orleton Court, Herefordshire: Second Prize, 10*l.*, for "Lorraine;" was calved July 26th; bred by himself; sire, "Viscount" (8140); dam, "Wild May," by "Giant" (5938); g. d., "May," by "Hailstorm" (5353); gr. g. d., "May Flower," by "Glendower 3rd" (3841); gr. g. g. d., "May Queen," by "Stout" (3477).

628 Henry William Taylor, Showle Court: Third Prize, 5*l.*, for "Gem;" was calved October 2nd; bred by himself; sire, "Franklin" (6961); dam, "Modesty," by "Tredegar" (5077); g. d., "Lovely," by "Tenant Farmer" (2806); gr. g. d., "Browny," by "Twin" (2284).

634 Richmond John Penhall, Broad Heath, Hallow, Worcestershire: the *Reserve Number* and *Highly Commended* for "Primrose 8th;" was calved July 25th; bred by himself; sire, "Castor" (8381); dam, "Primrose 7th," by "Hartington" (5358); g. d., "Primrose 2nd," by "Wolverhampton Boy" (4198); "gr. g. d., "Primrose," by "Triumph" (2836); gr. g. g. d., "Stately," by "Tell Tale" (1757).

Class 65.—*Hereford Heifers calved in the Year* 1885.

638 Rees Keene, Pencraig, Caerleon, Monmouthshire: First Prize, 20*l.*, for "Nancy Bangham;" was calved January 20th; bred by himself; sire, "Bangham" (6793); dam, "Nancy Cheerful," by "Cheerful" (5254); g. d., "Nancy," by "Tredegar" (4210); gr. g. d., "Blossom 3rd," by "Monaughty 2nd" (3261); gr. g. d., "Blossom," by "Patron 4th" (3301).

636 John Price, Court House, Pembridge, Herefordshire: Second Prize, 10*l.*, for "Sissie;" was calved April 23; bred by himself; sire, "Monarch" (7858); dam, "Spot 4th," by "Horace" (3877); g. d., "Spot," by "Cholstrey" (1918); gr. g. d., "Spot," by "Lord Clyde" (2084); gr. g. g. d., "Spot," by "Son of Koh-i-noor" (825).

642 Colonel Robert Bridgford, Kinnersley, Letton, Herefordshire: Third Prize, 5*l.*, for "Princess;" was calved June 5th; bred by himself; sire, "Regulator" (6637); dam, "Victoria 2nd," by "Regulus" (4076); g. d., "Victoria," by "Berrington" (2414); gr. g. d., "Princess Royal," by "Sir Thomas" (2428); gr. g. g. d., "Prize Flower," by "Arthur Napoleon" (918).

637 Thomas Lewis, The Woodhouse, Shobden, Herefordshire: the *Reserve Number* for "Florence;" was calved February 28th; bred by himself; sire, "Garrick" (8643); dam, "Florie," by "Benjamin" (6306); g. d., "Fillpail," by "Lion 2nd" (7086); gr. g. d., "Fillpail," by "Orleton" (3293); gr. g. g. d., "Fillpail," by "Lion" (2599).

Class 66.—*Hereford Bull and two Heifers, calved in the year* 1885.†

647 William Tudge, Leinthall, Ludlow: First Prize, 20*l.*, for "Regent;" was calved January 9th; sire, "Regal" (9121); dam, "Rhea," by "Romulus" (5542); g. d., "Rhoda," by "Sir Roger" (4133): "New Year's Gift;" was calved January 1st; sire, "Auctioneer" (5194); dam, "Rebe," by "Napoleon" (5476); g. d., "Rebecca," by "Cannon Ball" (4399): "Apple Blossom"; was calved March 5th; sire, "Auctioneer" (5194); dam, "Alexandra," by "Albert" (5182); g. d., "Fairmaid," by "Dauphin 4th" (4500); all bred by himself.

644 John Price, Court House, Pembridge, Herefordshire: Second Prize, 10*l.*, for "Goldfinder;" was calved January 15th; sire, "Monarch" (7858); dam, "Gipsy Queen 7th," by "Truro" (5677); g. d., "Gipsy Queen," by "Challenge" (3005a): "May Queen;" was calved May 9th; sire, "Monarch" (7858); dam, "Melody 3th," by "Zero alias Theodore 2nd" (5707); g. d., "Melody," by "Paragon" (2665): "Ethel;" was calved June 10th; sire, "Monarch" (7858); dam, "Ellen 5th," by "Grand Duke" (5342); g. d., "Ellen 4th," by "Challenge" (3005a); all bred by himself.

648 The Earl of Coventry, Croome Court, Severn Stoke, Worcestershire: the *Reserve Number* and *Highly Commended* for "Rare Metal;" was calved March 11th; sire, "Californian" (8355); dam, "Rarity 13th," by "Archduke" (4312); g. d., "Rarity 4th," by "Silver Prince" (5583): "Inspiration;" was calved on April 24th; sire, "Minstrel" (8915); dam, "Ivington Beauty," by "Ivington Boy" (4662); g. d., "Beauty 6th," by "Orleans" (2661): "Candy;" was calved May 11th; sire, "Californian" (8355); dam, "Tapioca," by "Fisherman" (5913); g. d., "Tapestry," by "Sultan 2nd" (5622); all bred by himself.

Class 67.—*Devon Bulls calved in either* 1881, 1882, 1883, *or* 1884.

651 John Walter, Bearwood, Wokingham, Berkshire: First Prize, 20*l.*, for "Young English Gentleman" (1869); was calved September 18th, 1883; bred by the late Mr. Walter Farthing, Stowey Court, Bridgwater, Somerset; sire, "Gentleman" (1566); dam, "Velveteen" (5702), by

† Given by the Hereford Herd-Book Society.

"Black Robin" (1290); g. d., "Linsey Woolsey" (3646), by "Able" (982); gr. g. d., "Plain Clothes" (3783), by "Sir George" (925); gr. g. g. d., "Lofty" (2832), by "Viscount" (746).

654 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: SECOND PRIZE, 10*l.*, for "Lord Cutsey 2nd" (1767); was calved November 4th, 1882; sire, "Fancy's Robin" (1556); dam, "Lady Cutsey" (5432), by "Lord Blagdon" (1377): and the *Reserve Number* and *Highly Commended* for (653) "General Gordon;" was calved February 12th, 1884; sire, "Lord Currypool" (1589); dam, "Moss Rose 3rd" (5532), by "Duke of Farrington" (1323); g. d., "Bouche's Moss Rose" (4124); gr. g. d., "Splendid 1st" (4955); both bred by himself.

CLASS 68.—*Devon Bulls calved in the Year* 1885.

657 SIR WILLIAM WILLIAMS, Bart., Heanton, Barnstaple, Devonshire: FIRST PRIZE, 20*l.*, for "Ferryman;" was calved February 15th; bred by himself; sire, "Candy;" dam, "Temptress 10th," by "Jonquil; g. d., "Temptress 4th," by "Duke of Flitton 4th;" gr. g. d., "Gold Medal Temptress," by "Davy's Napoleon 3rd;" gr. g. g. d., "Pink," by "Nelson."

658 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: SECOND PRIZE, 10*l.*, for "Duke of Pound 10th;" was calved July 10th; bred by himself; sire, "Lord Currypool" (1589); dam, "Duchess 7th" (5260), by "Duke of Farrington" (1323); g. d., "Duchess 3rd" (4418), by "Sir Wroth" (1451); gr. g. d., "Boucher's Duchess" (4123).

656 JOHN WALTER, Bearwood, Wokingham: the *Reserve Number* and *Highly Commended* for "Tempter the 2nd;" was calved March 5th; bred by himself; sire, "Tempter" (1852); dam, "Rosina" (7312), by "Prettyface's Duke" (1627); g. d., "Rose" (4903), by "Croydon Boy" (1309); gr. g. d., "Rosa 2nd" (3885), by "Duke of Devon" (1056); gr. g. g. d., "Red Rose" (3006), by "Royal Duke" (918a).

CLASS 69.—*Devon Cows or Heifers, in-milk or in-calf, calved previously to, or in the Year* 1883.

664 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard: FIRST PRIZE, 15*l.*, for "Moss Rose 8th" (7017); was calved February 5th, 1881; in-milk; calved January 21st, 1886; and in-calf; bred by the late Mr. Walter Farthing, Stowey Court, Bridgwater; sire, "Lord Stowey" (1601); dam, "Moss Rose 5th" (4758), by "a Son of Forester" (1108); g. d., "Moss Rose" (3716), by "Island Prince" (862); gr. g. d. "Modesty."

665 JOHN HOWSE, Leighland, Washford, Taunton, Somersetshire: SECOND PRIZE, 10*l.*, for "Daisy 4th" (5224); was calved April 20th, 1880, in-milk; calved May 15th, 1886; bred by himself; sire, "Nelson" (1413); dam, "Daisy 1st" (4360); g. d., "Daisy."

662 SIR WILLIAM WILLIAMS, Bart., Heanton, Barnstaple, Devonshire: the *Reserve Number* and *Highly Commended* for "Flame;" was calved April 17th, 1883, in-calf; bred by himself; sire, "Duke of Flitton 17th;" dam, "Famous 4th," by "Lord Stowey;" g. d., "Famous 2nd," by "Master Willie;" gr. g. d., "Famous," by a "Son of Lord Quantock;" gr. g. g. d., "Famous," by "Duke of Chester."

CLASS 70.—*Devon Heifers calved in the Year* 1884.

666 WILLIAM PERRY, Alder, Lewdown, Devonshire: FIRST PRIZE, 15*l.*, for "Rosette;" was calved May 22nd; bred by himself; "Benedict"

(1504); dam, "Rachel" (5620), by "Napoleon;" g. d., "Rachel 5th" (3868), by "Flitton" (1106); gr. g. d., "Rachel" (3866), by "St. Vincent" (1217).

669 John Walter, Bearwood, Wokingham, Berkshire: Second Prize, 10*l.*, for "Dairymaid 4th;" was calved May 11th; bred by himself; sire, "Prettyface's Duke" (1627); dam, "Dairymaid 2nd" (4321), by "Master Willie" (1163); g. d., "Young Dairymaid" (4018), by "Master Alic" (881); gr. g. d., "Dairymaid" (2614), by "Viscount" (746); gr. g. g. d., "Dairymaid" (1259), by "Earl of Exeter" (38): and the *Reserve Number* and *Highly Commended* for (670) "Grace;" was calved July 29th; bred by Mr. H. Farthing, Thurloxton, Taunton; sire, "Agricola" (1674); dam, "Graceful 2nd" (5367), by "Lord Newsham" (1391).

Class 71.—*Devon Heifers calved in the Year* 1885.

671 Her Majesty the Queen, Flemish Farm, Windsor: First Prize, 15*l.*, for "Fanciful;" was calved February 17th; bred by Her Majesty; sire, "Lord Currypool" (1589); dam, "Fancy 5th" (5293), by "Lily's Robin" (1582); g. d., "Fancy 3rd" (4478), by "Red Prince" (1432); gr. g. d., "Fancy 1st" (4476).

675 Sir William Williams, Bart., Heanton, Barnstaple Devonshire: Second Prize, 10*l.*, for "Frantic;" was calved March 25th; bred by himself; sire, "Duke of Flitton 17th;" dam, "Gentle;" g. d., "Gentle 1st."

673 John Walter, Bearwood, Wokingham, Berkshire: the *Reserve Number* and *Highly Commended* for "Gipsy Lass 2nd;" was calved April 19th; bred by himself; sire, "Tempter" (1852); dam, "Gipsy Lass" (5354), by "Master Walter" (1411); g. d., "Gipsy Girl" (4531), by "Forester" (1108); gr. g. d., "Cowslip" (3304), by "Sir George" (925); gr. g. g. d., "Cowslip" (3303), by "Master Alic" (881).

Class 72.—*Sussex Bulls calved in either* 1881, 1882, 1883, *or* 1884.

677 J. Stewart Hodgson, Lythe Hill, Haslemere, Surrey: First Prize, 20*l.*, for "Prince Rufus" (515); was calved July 31st, 1882; bred by himself; sire, "Young Oxford" (445); dam, "Laura 3rd" (2055), by "Little Tom;" g. d., "Laura 1st" (2053), by "Mottingham 1st" (190); gr. g. d., "Young Gentle."

679 Joseph Godman, Park Hatch, Godalming, Surrey: Second Prize, 10*l.*, for "Nobleman" (707); was calved April 30th, 1884; bred by himself; sire, "Napoleon 3rd" (396); dam, "Cauliflower" (2199); g. d., "Comely" (1482).

680 William Stewart Forster, Gore Court, Maidstone, Kent: the *Reserve Number* and *Highly Commended* for "Mikado" (705); was calved January 15th, 1884; bred by Mr. A. Holmes, Rye, Sussex; sire, "Steyning" (729); dam, "Lily."

Class 73.—*Sussex Bulls calved in the Year* 1885.

684 The Earl of Winterton, Shillinglee Park, Petworth, Sussex: First Prize, 20*l.*, for "Stafford" (726); was calved March 28th; bred by himself; sire, "Saxon" (558); dam, "Syren" (2499), by "Young Hartley" (444), g. d., "Sykes," by "Berry."

686 Edward and Alfred Stanford, Eatons, Ashurst, Steyning, Sussex; Second Prize, 10*l.*, for "Golddust 11th" (677); was calved May 1st: bred by themselves; sire, "Goldsmith" (391); dam, "Maypole 4th" (2438), by "Clayton" (319).

688 Joseph Godman, Park Hatch, Godalming, Surrey: the *Reserve Number* and *Highly Commended* for "Oxford Duke" (708); was calved February 10th; bred by himself; sire, "Lord Oxford" (461); dam, "Gentle 4th" (2601), by "Tavistock" (370); g. d., "Gentle" (1612), by "Sultan."

Class 74.—*Sussex Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1883.

693 Walter Blandford Waterlow, High Trees, Redhill, Surrey: First Prize, 15*l.*, for "Old Mayflower 4th" (3082); was calved January 9th, 1883; in-milk; calved March 19th, 1886; bred by Mr. A. Agate, Broadbridge Heath, Horsham, Sussex; sire, "Shirley" (436); dam, "Old Mayflower" (2913), by "Willards Hill;" g. d., "Young Mayflower" (2511); gr. g. d., "Old Mayflower:" and Second Prize, 10*l.*, for 692, "Confidence" (3013); was calved February 21st, 1882; in-milk; calved February 27th, 1886; bred by Mr. Thomas Vickress, Hill House, Slinfold, Horsham; sire, "Lord Stanley" (424); dam, "Christmas Rose" (1766); g. d., "Christmas Dark 2nd."

695 Edward and Alfred Stanford, Eatons, Ashurst, Steyning, Sussex: the *Reserve Number* and *Highly Commended* for "Dorset 8th" (2365); was calved March 11th, 1880; in-milk; calved February 15th, 1886; bred by himself; sire, "Goldsmith" (391); dam, "Dorset 2nd" (1993), by "Dorchester" (325); g. d., "Dorset" (1991), by "Young Westminster" (159).

Class 75.—*Sussex Heifers calved in the Year* 1884.

701 Walter Blandford Waterlow, High Trees, Redhill, Surrey: First Prize, 15*l.*, for "Daisy 6th" (3201); was calved January 7th; bred by Mr. A. Agate, Broadbridge Heath, Horsham, Sussex; sire, "General Roberts" (500); dam, "Daisy 4th" (2819), by "Sir Harry;" g. d., "Daisy 3rd."

700 J. Stewart Hodgson, Lythe Hill, Haslemere, Surrey: Second Prize, 10*l.*, for "Laura 7th" (3268); was calved January 6th; bred by himself; sire, "Lord Oxford" (461); dam, "Laura 3rd" (2055), by "Little Tom;" g. d. by "Laura 1st" (2053), by "Mottingham 1st" (190); gr. g. d., "Young Gentle."

705 William Stewart Forster, Gore Court, Maidstone, Kent: the *Reserve Number* and *Highly Commended* for "Heather Bell" (3478); was calved January 4th; bred by himself; sire, "Standen 3rd" (523); dam, "Bluebell" (1923).

Class 76.—*Sussex Heifers calved in the Year* 1885.

713 Joseph Godman, Park Hatch, Godalming: First Prize, 15*l.*, for "Noble Lady 2nd" (3451); was calved January 27th; bred by himself; sire, "Goldboy" (541); dam, "Noble Lady" (2911), by "Napoleon 3rd" (396); g. d., "Noble" (2270), by "The Bainden Bull;" gr. g. d., "Noble" (1800), by "Sultan."

706 Charles James Lucas, Warnham Court, Horsham, Sussex: Second Prize, 10*l.*, for "Honesty 8th;" was calved April 13th; bred by himself; sire, "Frankenstein 4th" (540); dam, "Honesty 7th" (3049), by "Shirley" (436); g. d., "Honesty 6th" (2867).

716 William Stewart Forster, Gore Court, Maidstone: the *Reserve Number* and *Highly Commended* for "Marygold 9th;" was calved

April 10th; bred by himself; sire, "Standen 3rd" (523); dam, "Marygold 4th" (2082), by "Tonbridge" (374); g. d., "Marygold 3rd" (2081).

CLASS 77.—*Welsh Bulls calved in either* 1881, 1882, 1883, *or* 1884.

721 THE EARL OF CAWDOR, Stackpole Court, Pembroke: FIRST PRIZE, 20*l.*, for "Zulu;" was calved July 26th, 1882; bred by Lord Harlech, of Tan-y-Bwlch, Harlech, N. Wales; sire, "Black Prince" (4); dam, "Beauty" (65).

718 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan, Carnarvonshire: SECOND PRIZE, 10*l.*, for "Ap Gwilyn;" was calved February, 1883; bred by Mr. William Jones, Taihirion, Gaerwen, Anglesey; sire, "Gwilyn;" dam, "Blackan;" g. d., "Blackan Back," by "Owain Tudor."

719 WILLIAM EDWARD OAKELEY, The Plas, Tan-y-Bwlch, Merionethshire: the *Reserve Number* and *Highly Commended* for "Duke of Chester;" was calved February 7th, 1882; bred by Captain J. C. Best, Vivod, Llangollen; sire, "Prince Llewellyn 3rd" (36); dam, "Welsh Duchess" (25), by "Prince of Wales 1st" (38); g. d., "Jenny."

CLASS 78.—*Welsh Bulls calved in the Year* 1885.

724 THE EARL OF CAWDOR, Stackpole Court, Pembroke: FIRST PRIZE, 20*l.*, for "John Evans;" was calved January 4th; bred by himself; sire, "Young King;" dam, "Annie" (246); g. d., "Annie Laurie 1st."

722 JOHN ROBERTS, The Gardens, Tan-y-Bwlch, Merionethshire: SECOND PRIZE, 10*l.*, for "Sir Watkin 2nd;" was calved February 7th; bred by himself; sire, "Duke of Chester" (20); dam, "Morwyn 3rd," by "Prince Llewellyn 1st" (35); g. d., "Morwyn 2nd," by "Prince of Wales 1st" (38); gr. g. d., "Morwyn 1st."

723 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan, Carnarvonshire: the *Reserve Number;* was calved May 27th; bred by himself.

CLASS 79.—*Welsh Cows or Heifers, in-milk or in-calf, calved previously to or in the Year* 1883.

725 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan: FIRST PRIZE, 15*l.*, for "Black Queen 3rd;" was calved September 13th, 1879; calved November 10th, 1885, and in-calf; bred by Mr. S. L. Parry, Craflwyn, Beddgelert, N. Wales; sire, "Prince Llewellyn 3rd;" dam, "Black Queen 2nd," by "Prince Llewellyn 1st;" g. d., "Black Queen 1st;" gr. g. d., "Jenny."

726 THE EARL OF CAWDOR, Stackpole Court, Pembroke: SECOND PRIZE, 10*l.*, for "Rosal 2nd;" was calved March 29th, 1881; calved November 17th, 1885, and in-calf; bred by Mrs. L. Williams, Love Lodge, Llandilo; sire, "Symen 2nd;" dam, "Gymras" (23), by "Gymro" (26).

728 ALEXANDER MILNE DUNLOP, Hafod-y-bryn Farm, Llanbedr, Merionethshire: the *Reserve Number* and *Highly Commended* for "Lady Best;" was calved in 1883; in-calf; bred by Captain J. C. Best, Vivod, Llangollen; sire, "Prince Llewellyn 3rd" (36).

CLASS 80.—*Welsh Heifers, calved in the Year* 1884.

729 COLONEL H. PLATT, Gorddinog, Llanfairfechan, Carnarvonshire: FIRST PRIZE, 15*l.*; was calved February 15th; bred by himself; sire, "Black Prince 2nd" (6).

733 LORD HARLECH, Glyn: SECOND PRIZE, 10*l.*; was calved March 28th; bred by himself; sire, "Cipher" (11); dam, "Vesta" (51).

731 WILLIAM EDWARD OAKELEY, The Plas, Tan-y-Bwlch, Merionethshire: the *Reserve Number* and *Highly Commended* for "Hatty;" was calved January 2nd; in-milk; calved March 11th, 1886, and in-calf; bred by himself; dam, "Netty."

CLASS 81.—*Welsh Heifers, calved in the Year* 1885.

737 WILLIAM EDWARD OAKELEY, the Plas, Tan-y-Bwlch: FIRST PRIZE, 15*l.*, for "Kitty;" was calved January 6th; bred by himself; sire, "Duke of Chester" (20); dam, "Netty."

739 MRS. LETTICE WILLIAMS, Love Lodge, Llandilo, Carmarthenshire: SECOND PRIZE, 10*l.*, for "Vivanderia;" was calved January 20th; bred by herself; sire, "Ap Lyman" (127); dam, "Bloom" (320), by "Tichborne 2nd" (64).

735 COLONEL HENRY PLATT, Gorddinog, Llanfairfechan: the *Reserve Number* and *Highly Commended;* was calved January 29th; bred by himself.

CLASS 82.—*Red Polled Bulls, calved previously to the Year* 1883.‡

749 GARRETT TAYLOR, Trowse House, Norwich: FIRST PRIZE, 20*l.*, and the CHAMPION PRIZE, 25*l.*,† for "Falstaff" (303); was calved February 5th, 1876; bred by the Rev. A. G. Legge, Rectory Farm, Elmhalm, Norfolk; sire, "Rufus" (188); dam, "Fanny Bradfield" (891), by "Money" (352); g. d., "Nancy" (A. 11).

753 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: SECOND PRIZE, 10*l.*, for "Don Carlos" (659); was calved November 18th, 1882; bred by himself; sire, "King Charles" (329); dam, "Miss Atkins" (1023), by "Powell" (143); g. d., "Lady Atkins" (290), by "Norfolk Duke" (127); gr. g. d., "Primrose" (433), by "Tenant Farmer" (213); gr. g. g. d., "Cherry."

755 PETER KERSEY BLOFIELD, Quiddenham, Thetford, Norfolk: THIRD PRIZE, 5*l.*, for "Doncaster" (661); was calved July 5th, 1882; bred by the Duchess of Hamilton, Easton Park Farm, Wickham Market: sire, "Wilby Lad" (599); dam, "Radish" (1761), by "Norfolk Duke" (127); g. d., "Rosy" (510), by "Duke" (52).

747 ALFRED TAYLOR, Starston Place, Harleston, Norfolk: the *Reserve Number* and *Highly Commended* for "Passion" (714); was calved January 2nd, 1881; bred by himself; sire, "King Charles" (329); dam, "Sly" (1192), by "Sir Edward 1st" (197); g. d., "Strawberry" (575), by "Richard 2nd" (173); gr. g. d., "Tiny" (604), by "Laxfield Sire" (101).

CLASS 83.—*Red Polled Bulls calved in the Year* 1883.‡

758 WILLIAM AMHURST TYSSEN-AMHERST, Didlington Hall, Brandon, Norfolk: FIRST PRIZE, 20*l.*, and the *Reserve Number* for Champion Prize, for "Didlington Davyson 2nd" (657); was calved January 7th;

† Given by the Mayor of Norwich, John Gurney, Esq., for the best Red Polled male, in Classes 82 to 85.

‡ Given conjointly by the Norwich Local Committee and the Suffolk Agricultural Association.

bred by himself; sire, "Davyson 12th" (481); dam, "Davy 24th" (1448), by "Davyson 5th" (287); g. d., "Davy 15th" (844), by "Davyson 3rd" (48); gr. g. d., "Davy 5th" (167), by "Tenant Farmer" (213); gr. g. g. d., "Davy" (H. 1).

760 Thomas Brown, Marham Hall, Downham Market, Norfolk: Second Prize, 10*l.*, for "Frederick" (894); was calved December 27th; bred by himself; sire, "Pliny" (724); dam, "Faith" (1504), by "Norfolk Duke" (127); g. d., "Florence" (898), by "The Palmer" (138); gr. g. d., "Thursford Rose" (600), by "Norfolk Duke" (127); gr. g. g. d., "Rose P. 3" (478).

756 Robert Harvey Mason, Necton Hall, Swaffham, Norfolk: Third Prize, 5*l.*, for "Napoleon" (897); was calved February 17th; bred by himself: sire, "Davyson 3rd" (48); dam, "Empress" (1496), by "King Harry" (332); g. d. "Rose 2nd" (1143), by "Lougham" (104); gr. g. d., "Daisy" (152), by "Necton 3rd" (122); gr. g. g. d., "Rose" (476), by "Necton Prize" (120).

Class 84.—*Red Polled Bulls calved in the Year* 1884.

767 John Hammond, Bale, Dereham, Norfolk: First Prize, 20*l.*, for "Davyson 18th" (822); was calved February 20th; bred by himself; sire, "Davyson 16th" (653); dam, "Davy 29th," by "Davyson 6th;" g. d., "Davy 7th," by "Young Duke" (234); gr. g. d., "Davy 2nd," by "Sir Nicholas" (202); gr. g. g. d., "Davy" (163), by "Powell Bull."

775 Thomas Brown, Marham Hall, Downham Market, Norfolk: Second Prize, 10*l.*, for "Paragon" (903); was calved May 6th; bred by himself; sire, "Goshawk" (497); dam, "Pensive" (1729), by "Norfolk Duke" (127); g. d. "Penelope" (1069), by "Roundhead" (180); gr. g. d., "Nelly" (372), by "Redjacket 7th" (169); gr. g. g. d., "Handsome 2nd" (244), by "Tenant Farmer" (213).

773 Jeremiah James Colman, M.P., Carrow House, Norwich: Third Prize, 5*l.*, for "The Moor" (894); was calved September 11th; bred by himself; sire, "Othello" (713); dam, "Dolly" (1463), by "Rufus" (188); g. d., "Polly," by "Rufus" (189).

769 The Duke of Hamilton and Brandon, K.T., Easton Park, Wickham Market, Suffolk: the *Reserve Number* and *Highly Commended* for "Orlando" (900); was calved July 13th; bred by himself; sire, "Perfect" (536); dam, "Jessie" (961), by "Theodore" (417); g. d., "Jenny" (279), by "The Peer" (139); gr. g. d., "Ruby 4th" (518), by "Tenant Farmer" (213); gr. g. g. d., "Ruby 2nd," (517), by "Hero 2nd" (86).

Class 85.—*Red Polled Bulls calved in the Year* 1885.

794 Jeremiah James Colman, M.P., Carrow House, Norwich: First Prize, 20*l.*, for "Iago" (1025); was calved January 20th; bred by himself; sire, "Othello" (713); dam, "Silent Lady" (1855), by "Rufus" (188); g. d., "Silent Lass" (1189), by "Powell" (143); gr. g. d., "Silence," by "Rifleman" (175).

791 Lord Hastings, Melton Constable, East Dereham, Norfolk: Second Prize, 10*l.*, for "Erebus" (841); was calved April 24th; bred by Mr. T. Fulcher, Elmham, Dereham; sire, "Falstaff" (303); dam, "Elmbranch" (1482), by "Rufus" (188); g. d., "Elmer" (198), by "Elmham Sire" (67).

787 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: THIRD PRIZE, 5*l.*, for "Blandford" (958); was calved March 1st; bred by Mr. T. Fulcher, Elmham, Dereham, Norfolk; sire, "Falstaff" (303); dam, "Vestal" (2595), by "Brutus" (269); g. d., "Violet 2nd" (1925), by "The Palmer" (138); gr. g. d., "Violet A. 26" (1924), by "Hero 2nd" (86).

785 JOHN HAMMOND, Bale, Dereham, Norfolk: the *Reserve Number* and *Highly Commended* for "Davyson 24th" (1000); was calved May 23rd; bred by himself; sire, "Joskins" (1027); dam, "Davy 27th" (1451), by "Davyson 25th" (287); g. d., "Davy 5th," by "Tenant Farmer" (213).

CLASS 86.—*Red Polled Cows or Heifers, in-milk or in-calf, calved previously to the Year* 1883.

821 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: FIRST PRIZE, 20*l.*, and CHAMPION PRIZE,† 25*l.*, for "Dolly" (1463); was calved November 3rd, 1879; in-milk; calved December 23rd, 1885; and in-calf; bred by himself; sire, "Rufus" (188); dam, "Polly" (1084), by "Rufus" (188); g. d., "Lily 2nd," by "Hero 3rd" (87); gr. g. d. "Lily," by "Hero of Newcastle" (85).

804 JOHN HAMMOND, Bale, East Dereham: SECOND PRIZE, 10*l.*, for "Davy 28th;" was calved in 1879; in-milk; calved March 1st, 1886; and in-calf; bred by himself; sire, "Davyson 6th" (475); dam, "Davy 15th," by "Davyson 3rd" (48).

824 JEREMIAH JAMES COLMAN, M.P., Carrow House: THIRD PRIZE, 5*l.*, for "Rosalie" (2495); was calved August 25th, 1882; in-milk; calved February 22nd, 1886; and in-calf; bred by himself; sire, "King Charles" (329); dam, "Rosebud" (1797), by "Rufus" (188); g. d., "Rosebud" (494), by "Norfolk Duke" (127); gr. g. d., "Cherry 2nd."

803 JOHN HAMMOND, Bale: the *Reserve Number* and *Highly Commended* for "Davy 15th" (844); was calved November, 1874; in-milk; calved March 5th, 1886; bred by himself; sire, "Davyson 3rd" (48); dam, "Davy 5th," by "Tenant Farmer" (213); g. d., "Davy" (H. 1).

CLASS 87.—*Red Polled Heifers, calved in the Year* 1883.

832 ALFRED TAYLOR, Starston Place, Harleston, Norfolk: FIRST PRIZE, 20*l.*, for "Bugle" (2664); was calved February 18th; bred by himself; sire, "Starston Duke" (570); dam, "Buxom" (1355), by "Davyson 3rd" (48); g. d., "Cheerful" (762), by "Young Major" (255); gr. g. d., "Spot" (K. 19), by "Wonder" (231); gr. g. g. d. "Rose" (K. 19).

831 JOHN HAMMOND, Bale: SECOND PRIZE, 10*l.*, for "Davy 54th" (2741); was calved August 5th; in-calf; bred by himself; sire, "Davyson 7th" (476); dam, "Davy 27th" (1451), by "Davyson 5th" (287); g. d., "Davy 5th" (167), by "Tenant Farmer" (2131).

837 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: THIRD PRIZE, 5*l.*, for "Easton Rose" (2773); was calved September 10th; bred by himself; sire, "Roundhead" (564); dam, "Rosamond" (1789), by "Rufus" (188); g. d., "Rosa" (1133), by "Norfolk Duke" (127); gr. g. d., "Rose 3rd" (480), by "Young Duke" (234).

† Given by the Mayor of Norwich, John Gurney, Esq., for the best Red Polled female in Classes 86 to 89.

834 LORD HASTINGS, Melton Constable, East Dereham, Norfolk: the *Reserve Number* for "Ruperta" (3126); was calved October 20th; in-calf; bred by himself; sire, "Roscoe" (559); dam, "Davy 19th" (848), by "Davyson 3rd" (48); g. d., "Davy 12th" (174), by "The Baron" (9); gr. g. d., "Davy 5th" (167), by "Tenant Farmer" (203); gr. g. g. d., "Davy" (H. 1).

CLASS 88.—*Red Polled Heifers, calved in the Year* 1884.

857 JEREMIAH JAMES COLMAN, M.P., Carrow House: FIRST PRIZE, 15*l*., and the *Reserve Number* for Champion Prize for "Midsummer Rose" (2976); was calved June 26th; bred by himself; sire, "Othello" (713); dam, "Rosebud" (1797), by "Rufus" (188); g. d., "Rosebud" (494), by "Norfolk Duke" (127); gr. g. d., "Cherry" (K. 17).

860 WILLIAM AMHURST TYSSEN-AMHERST, Didlington Hall, Brandon: SECOND PRIZE, 10*l*., for "Emblem" (2782); was calved February 4th; bred by himself; sire, "Davyson 3rd" (48); dam, "Eleanor" (1477), by "Brutus" (269); g. d., "Elmer" (1483), by "Elmham Sire" (67).

851 ALFRED TAYLOR, Starston Place, Harleston, Norfolk: THIRD PRIZE, 5*l*., for "Fascination" (2803); was calved October 19th; bred by himself; sire, "Kelpie" (685); dam, "Fashion" (1510), by "King Charles" (329); g. d., "Sly" (1192), by "Sir Edward 1st" (197); gr. g. d., "Strawberry" (575), by "Richard 2nd" (173).

853 LORD HASTINGS, Melton Constable: the *Reserve Number* and *Highly Commended* for "Melton Rose 5th" (2972); was calved April 20th; in-calf; bred by himself; sire, "Roscoe" (559); dam, "Melton Rose 2nd" (2365), by "Thornham Duke 2nd" (585); g. d., "Rosebud" (1804), by "Norfolk John" (131); gr. g. d., "Rose" (481), by "Redjacket 7th" (169); gr. g. g. d., "Polly" (416).

CLASS 89.—*Red Polled Heifers, calved in the Year* 1885.

871 JOHN HAMMOND, Bale, Dereham, Norfolk: FIRST PRIZE, 15*l*., for "Davy 63rd" (3361); was calved January 5th; bred by himself; sire, "Roland" (739); dam, "Davy 48th" (2140), by "Davy Butler" (483); g. d., "Davy 34th" (1458), by "Davyson 6th" (475).

883 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: SECOND PRIZE, 10*l*., for "Silent Belle" (3739); was calved January 12th; bred by himself; sire, "Haman" (499); dam, "Silent Beauty" (2536), by "King Charles" (329); g. d. "Silent Lass" (1189), by "Powell" (143); gr. g. d. "Silence," by "Rifleman" (175).

872 JOHN HAMMOND, Bale: THIRD PRIZE, 5*l*., for "Davy 65th" (3363); was calved May 6th; sire, "Joskins" (1027); dam, "Davy 23rd" (1447), by "Davyson 5th" (287); g. d., "Davy 17th," by "Redjacket 7th" (169): and the *Reserve Number* and *Highly Commended* for 873 "Davy 64th" (3362); was calved January 30th; sire, "Roland" (739); dam, "Davy 37th" (2130), by "Davyson 7th" (476); g. d., "Davy 21st" (1445), by "Davyson 5th" (287); both bred by himself.

CLASS 90.—*Jersey Bulls, calved in either* 1881, 1882, 1883, *or* 1884.

903 S. H. HYDE, Kempton Park, Sunbury, Middlesex: FIRST PRIZE, 20*l*., for "Royal Blue," fawn; was calved February 17th, 1884; bred by Mr. Thomas Touzel, Grouville, Jersey; sire, "Gilderoy" (1622); dam, "Castalades" (2876 J.H.B.).

917 THE HON. COPLESTONE R. G. W. BAMPFYLDE, Bretton Park, Wakefield, Yorkshire: SECOND PRIZE, 10*l.*, for "St. Mary's King," brown; was calved December 1st, 1883; bred by Mr. Jean Carabin, St. Mary's, Jersey; sire, "Augurez King" (1317 E.H.B.); dam, "Allemande" (3726 J.H.B.).

902 S. H. HYDE, Kempton Park: THIRD PRIZE, 5*l.*, for "Dog Fox," silver grey; was calved May 1st, 1884; bred by the late Mr. Cardus, Southampton; sire, "Baron Lionel" (994); dam, "Vixen," by "Dairy King" (211); g. d., "Velveteen," by "Grey Prince" (385).

897 THOMAS SHAW, Oakes House, Holywell Green, Halifax, Yorkshire: the *Reserve Number* and *Highly Commended* for "The Speaker," bronze fawn; was calved April 16th, 1883; bred by Mr. F. P. Valpy, Grouville, Jersey; sire, "Favor" (365 J.H.B.); dam, "Rosette 2nd" (943).

CLASS 91.—*Jersey Bulls calved in the Year* 1885.

947 WILLIAM ARKWRIGHT, Sutton Scarsdale, Chesterfield, Derbyshire: FIRST PRIZE, 20*l.*, for "Scarsdale Astronomer Royal," fawn; was calved January 22nd; bred by Mr. J. E. Brée, St. Clement's, Jersey; sire, "Royal Guénon" (545 J.H.B.); dam, "Aster" (970 J.H.B.); g. d., "Rosy" (399 J.H.B.).

938 HENRY JAMES CORNISH, Thornford, Sherborne, Dorsetshire: SECOND PRIZE, 10*l.*, for "Brilliant," dark grey; was calved May 5th; bred by Mr. W. Alexander, jun., St. Mary's, Jersey; sire, "Wolseley" (2165 E.H.B.); dam, "Diana's Pride" (5152 J.H.B.).

933 S. H. HYDE, Kempton Park, Sunbury: THIRD PRIZE, 5*l.*, for "King Oscar," fawn; was calved May 12th; bred by Mr. J. H. Orange, St. Brelade's Bay, Jersey; sire, "Buttermaker Boy" (432 J.H.B.); dam, "Bude Light" (6644).

925 GEORGE WILLIAM PALMER, Elmhurst, Reading, Berkshire: the *Reserve Number* and *Highly Commended* for "Baron Elmhurst," silver grey; was calved March 21st; bred by himself; sire, "Nero du Coin;" dam, "Browny of the Elms," by "King" (238 J.H.B.); g. d., "Brown 4th" (289 J.H.B.), by "Tom" (177 J.H.B.); gr. g. d., "Brown 3rd" (1533); gr. g. g. d., "Brown" (966).

CLASS 92.—*Jersey Cows, in-milk or in-calf, calved previously to or in the Year* 1882.

970 HENRY JAMES CORNISH, Thornford, Sherborne, Dorsetshire: FIRST PRIZE, 15*l.*, for "Bragga," brown fawn; was calved April 2nd, 1881; in-milk; calved February 4th, 1886; bred by Mr. J. Allier, St. Clement's, Jersey; sire, "Cettwayo" (1425 E.H.B.); dam, "Leonore" (2403 J.H.B.).

975 JAMES BLYTH, Wood House, Stanstead, Essex: SECOND PRIZE, 10*l.*, for "Rosy," light red; was calved February 17th, 1879; in-milk; calved June 5th, 1886; bred by Mrs. de la Cour, St. Mary's Jersey; sire, "Carlo;" dam, "Belle," by "Orange Peel 2nd;" g. d., "Marie Spelterini," by "Cadina."

956 GEORGE SIMPSON, Wray Park, Reigate, Surrey: THIRD PRIZE, 5*l.*, for "Bessie" (149), grey fawn; was calved May 12th, 1879; in-calf; bred by Mr. P. Mourant, St. Saviour's, Jersey; sire, "Noble 2nd" (1172 E.H.B.); dam, "Beauty" (J.H.B.).

974 JAMES BLYTH, Wood House: the *Reserve Number* and *Highly Commended* for "Sweet Secret," cream; was calved December 11th, 1882; in-milk; calved June 1st, 1886; bred by Mr. George Collas, St. Saviour's, Jersey; sire, "Cicero" (266 J.H.B.); dam, "Secret" (2375 J.H.B.).

CLASS 93.—*Jersey Cows or Heifers, in-milk or in-calf, calved in the Year* 1883.

989 HENRY JAMES CORNISH, Thornford, Sherborne, Dorset: FIRST PRIZE, 15*l.*, for "Leonora," silver grey; was calved June 20th; in-milk; calved April 25th, 1886; bred by Mr. J. P. Falle, St. Martin's, Jersey; sire, "Franklin" (376 J.H.B.); dam, "Duchess of Waverley" (5879 J.H.B.).

983 GEORGE SIMPSON, Wray Park, Reigate, Surrey: SECOND PRIZE, 10*l.*, for "Bernice," grey fawn; was calved February 6th; in-calf; bred by himself; sire, "Farmer's Joy" (1075); dam, "Beatrice," by "Sir Thomas" (1246); g. d., "Belle des Quesnais."

992 SIR EDWARD BIRKBECK, Bart., Horstead Hall, Norwich: THIRD PRIZE, 5*l.*, for "Bluebell," silver grey; was calved April 9th; in-milk; calved May 30th, 1885; bred by himself; sire, "Bismarck;" dam, "Bridesmaid," by "Dairy King;" g. d., "Bride," by "Banboy;" gr. g. d., "Victoria."

993 JAMES BLYTH, Wood House, Stanstead, Essex: the *Reserve Number* and *Highly Commended* for "Perry Farm Deery," light grey; was calved December 23rd; in-milk; calved May 25th, 1886; bred by Mr. G. A. Desreaux, Perry Farm, St. Mary's, Jersey; sire, "Wolseley" dam, "St. John's Buttercup," by "St. John's."

CLASS 94.—*Jersey Heifers calved in the Year* 1884.

1020 HENRY JAMES CORNISH, Thornford, Sherborne, Dorset: FIRST PRIZE, 15*l.*, for "Golden Skin 2nd," fawn; was calved June 3rd; in-calf; bred by Mr. F. Le Brocq, St. Owen's, Jersey; sire, "Nero du Coin" (1849 E.H.B.); dam, "Golden Skin" (5508 J.H.B.).

1026 SALISBURY BAXENDALE, Bonningtons, Ware, Hertfordshire: SECOND PRIZE, 10*l.*, for "Marigold," whole colour; was calved April 10th; in-calf; bred by himself; sire, "Young Neptune" (1847); dam, "Marjoram," by "Don" (248); g. d., "Primrose," by "Gipsy King" (357); gr. g. d., "Crocus," by "Banboy" (17); gr. g. g. d., "Marigold."

1022 HENRY JAMES CORNISH, Thornford: THIRD PRIZE, 5*l.*, for "Peupliers Lily," dark fawn; was calved May 10th; in-calf; bred by Mr. F. Le Brocq, St. Owen's, Jersey; sire, "Duke of Grautez" (410 J.H.B.); dam, "Lily" (1541 J.H.B.).

1018 JEREMIAH JAMES COLMAN, M.P., Carrow House, Norwich: the *Reserve Number* and *Highly Commended* for "Comfort," grey fawn; was calved November 1st; in-milk; calved May 6th, 1886; bred by himself; sire, "Golden Horn" (480 J.H.B.); dam, "Melvina 2nd" (J.H.B.); g. d., "Melvina" (2806), by "Welcome;" gr. g. d., "Saturn" (2139), by "Beeswing."

CLASS 95.—*Jersey Heifers calved in the Year* 1885.

1062 HENRY JAMES CORNISH, Thornford, Sherborne, Dorset: FIRST PRIZE, 15*l.*, for "Nero's Deery," fawn; was calved May 6th; bred by Mr. P. J. Brideaux, St. Helier's, Jersey; sire, "Nero du Coin" (1849 E.H.B.); dam, "Young Lady" (927 J.H.B).

1068 JAMES BLYTH, Wood House, Stanstead, Essex: SECOND PRIZE, 10*l.*, for "Pat's Mate," fawn; was calved May 16th; bred by himself; sire, "Monarch of Maitland;" dam, "Patience," by "Bonaparte;" g. d., "Lady Jane," by "Neptune"; gr. g. d., "Queen of the South."

1042 LORD LONDESBOROUGH, Northerwood, Lyndhurst, Hampshire: THIRD PRIZE, 5*l.*, for "Governess," fawn; was calved January 2nd; bred by himself; sire, "Rainbow" (1943 E.H.B.); dam, "Dame Suzeraine."

1060 HENRY JAMES CORNISH, Thornford: the *Reserve Number* and *Highly Commended* for "Little Wonder," fawn; was calved March 11th; bred by the late Dr. Wills, St. Helier's, Jersey; sire, "Nero du Coin" (1849 E.H.B.); dam, "Doctress" (480 J.H.B.).

CLASS 96.—*Guernsey Bulls calved in either* 1881, 1882, 1883, *or* 1884.

1081 THE EXPRESS DAIRY CO. (Limited), College Farm, Finchley, Middlesex: FIRST PRIZE, 15*l.*, for "Climax" (14 E.G.H.B.), orange fawn and white; was calved June 18th, 1882; bred by Mr. W. Le Ray, Sergentée, Guernsey; sire, "Presto" (14); dam, "Victory 1st" (1052).

1076 THE HON. MRS. A. BAILLIE HAMILTON, Combs, Stowmarket, Suffolk: SECOND PRIZE, 10*l.*, for "Loyal" (37 E.G.H.B.), fawn and white; was calved in May, 1881; bred by Mr. P. Martel, Hougue Fouque, St. Saviour's, Guernsey; sire, "Dummy" (103).

1079 WILLIAM ANTHONY GLYNN, Seagrove, Seaview, Isle of Wight: the *Reserve Number* and *Highly Commended* for "Hopeful" (25 E.G.H.B.), lemon fawn and white; was calved May 17th, 1884; bred by himself.

CLASS 97.—*Guernsey Bulls calved in the Year* 1885.

1087 THE HON. MRS. A. BAILLIE HAMILTON, Combs: FIRST PRIZE, 15*l.*, for "Loyalist," red and white; was calved January 6th; bred by herself; sire, "Loyal" (37 E.G.H.B); dam, "Buttercup" (34 E.G.H.B.).

1084 GEORGE NEVILE WYATT, Slough Place, Cuckfield, Sussex: SECOND PRIZE, 10*l.*, for "Confidence" (88 E.G.H.B), red fawn and white; was calved May 22nd; bred by Mr. D. O. Le Patourel, Les Quartiers, Guernsey.

1089 MAJOR HERBERT L. GREEN, Ville Amphrey, St. Martin's, Guernsey: the *Reserve Number* and *Highly Commended* for "Master Tom 2nd," fawn and white; was calved July 5th; bred by himself; sire, "Master Tom;" dam, "La Rose 3rd," by "Rollo;" g. d., "La Rose 2nd," by "Cloth of Gold 8th;" gr. g. d., "La Rose."

CLASS 98.—*Guernsey Cows or Heifers, in-milk or in-calf, calved in* 1883.

1091 MAJOR HERBERT L. GREEN, Ville Amphrey, St. Martin's, Guernsey: FIRST PRIZE, 15*l.*, for "Constance 2nd," fawn and white; was calved January 15th, in-calf; bred by Mr. D. Le Cheminante, St. Peter's in the Wood, Guernsey; sire, "Presto;" dam, "Constance;" g. d., "La Grande."

1092 WILLIAM ANTHONY GLYNN, Seagrove, Seaview, Isle of Wight: SECOND PRIZE, 10*l.*, for "Fairy 3rd," lemon fawn and white; was calved June 5th; in-milk; calved June 14th, 1886; bred by himself; sire, "Billy 4th" (7 E.G.H.B.); dam, "Fairy 2nd" (105 E.G.H.B.), by "Honest Tom 1st;" g. d., "Fairy 1st," by "Johnny 1st;" gr. g. d., "Jenny 1st."

1095 THE EXPRESS DAIRY Co., (Limited), College Farm, Finchley, Middlesex: the *Reserve Number* and *Highly Commended* for "Brightsmile," dark fawn and white; was calved January 28th; in-milk; calved May 16th; bred by Mr. A. J. Naftel, Grand Fort, Guernsey; sire, "Fair Lad;" dam, "Lady Flora," by "Brutus;" g. d., "Jesse."

CLASS 99.—*Guernsey Heifers, calved in the Year* 1884.

1096 GEORGE NEVILE WYATT, Slough Place, Cuckfield, Sussex: FIRST PRIZE, 15*l.*, for "Enid" (353 E.G.H.B.), red and white; was calved March 27th, in-milk; bred by Miss de Garis, Neuf Chemin, St. Saviour's, Guernsey.

1102 THE EXPRESS DAIRY COMPANY (Limited), College Farm: SECOND PRIZE, 10*l.*, for "Tostevine 2nd," orange fawn and white; was calved March 6th; in-milk; calved May 13th; bred at the Country Hospital, Câtel, Guernsey; sire, "Nimrod;" dam, "Tostevine:" and the *Reserve Number* and *Highly Commended* for (1104) "Belle of the West," red and white; was calved January 12th; in-milk; calved May 16th; bred by Mr. N. Bourgaize, Couché, St. Peter in the Wood, Guernsey; sire, "Windsor;" dam, "Tenny."

CLASS 100.—*Guernsey Heifers calved in the Year* 1885.

1113 WILLIAM ANTHONY GLYNN, Seagrove, Seaview, Isle of Wight: FIRST PRIZE, 15*l.*, for "Honesty 2nd" (374 E.G.H.B.), lemon fawn and white; was calved February 4th; bred by himself; sire, "Bonnie Boy 1st" (8 E.G.H.B.); dam, "Honesty 1st" (155 E.G.H.B); g. d., "Jenny 1st," by "Johnny 1st."

1116 THE EXPRESS DAIRY COMPANY (Limited), College Farm: SECOND PRIZE, 10*l.*, for "College Belle," red and white; was calved February 28th; bred by themselves; sire, "Rosebud;" dam, "Canterbury Belle," by "Presto;" g. d., "Carrée," by "St. Andews 1st;" gr. g. d., "Grande Paysanne."

1107 THE HON. MRS. A. BAILLIE HAMILTON, Combs, Stowmarket: the *Reserve Number* and *Highly Commended* for "Rosabelle" (455 E.G.H.B.), red and white; was calved July 21st; bred by herself; sire, "St. Peter" (60 E.G.H.B.); dam, "Fair Rosamond."

CLASS 101.—*Bulls of any other breed calved in either* 1881, 1882, 1883 *or* 1884.

1122 CLEMENT STEPHENSON, Balliol College Farm, Long Benton, Newcastle-on-Tyne: FIRST PRIZE, 15*l.*, for "Evander" (3717) (Aberdeen or Angus), black; was calved January 19th, 1884; bred by Sir G. Macpherson Grant, Bart., Ballindalloch, N.B.; sire, "Julius" (1819); dam, "Evening" (4187), by "Electro" (595); g. d., "Eva" (984), by "Victor of Ballindalloch" (403); gr. g. d., "Eisa" (977), by "Trojan" (402); gr. g. g. d., "Erica" (843), by "Cupbearer" (59).

1119 EDWARD ARTHUR ROBERTS, Woodlands, Greenhithe, Dartford, Kent: SECOND PRIZE, 10*l.*, for "Silver King" (Ayrshire), black and white; was calved April 12th, 1883; bred by Mr. J. Wallace, Piperhill, Ochiltree, Ayrshire; sire, "Hover;" dam, "Bank."

1121 CLEMENT STEPHENSON, Balliol College Farm: *Reserve Number* and *Commended* for "Grandmaster" (4707) (Aberdeen or Angus), black; was calved December 5th, 1884; bred by himself; sire, "Englishman"

(2706); dam, "Gravity" (4864), by "Nicholas" (1210); g. d., "Duchess Marie" (3410), by "Hampton" (492); gr. g. d., "Daisy of Montbletton" (1025), by "Victor of Ballindalloch" (403); gr. g. g. d., "Lady Ida" (1021), by "Black Diamond" (464).

Class 102.—*Bulls of any other breed calved in the Year* 1885.

1126 Robert Loder, Whittlebury, Towcester, Northamptonshire: First Prize, 15*l.*, for "Pluto" (Polled Angus), black; was calved March 14th; bred by himself; sire, "McDonald" (2983); dam, "Queen Mary of Glamis" (3312), by "Neptune" (1152); g. d., "Queen Mary 12th" (3514), by "Marquess of Perth" (726); gr. g. d., "Queen Mary 5th" (2360), by "Lochiel" (723); gr. g. g. d., "Mary Ann of Mulban" (1039), by "Prince of Wales" (453).

Class 103.—*Cows or Heifers of any other breed, in-milk or in-calf, calved in the Year* 1883.

1133 William Bruce Greenfield, Beechwood Park, Dunstable: First Prize, 15*l.*, for "Manilla 3rd" (8658) (Polled Aberdeen or Angus), black; was calved May 13th; in-calf; bred by himself; sire, "Bombastes" (1548); dam, "Manilla" (4189), by "Belus" (749); g. d. "Mana" (3045), by "Juryman" (404); gr. g. d., "Young Farnell" (1122), by "King Henry" (390); gr. g. g. d., "Farnell of the Thorn" (1224), by "President 3rd."

1129 James Robertson, La Mancha, Malahide, County Dublin: Second Prize, 10*l.*, for "Silene" (Dexter Kerry), black; in-milk; calved April 26th, 1886; breeder unknown.

Class 104.—*Heifers of any other breed, calved in the Year* 1884.

1148 Clement Stephenson, Balliol College Farm, Long Benton, Newcastle-on-Tyne: First Prize, 15*l.*, for "Lady Victorine" (8236) (Aberdeen or Angus), black; was calved July 29th; in-calf; bred by the Hon. C. Carnegie, Mont Melville St. Andrews; sire, "Royal Victor" (1780); dam, "Lady Day" (2433), by "Elector" (427); g. d., "Grace Darling 2nd" (1071), by "Priam" (467): and Second Prize, 10*l.*, for (1147) "Ruth of Benton" (9271) (Aberdeen or Angus), black; was calved May 12th; in-calf; bred by himself; sire, "Englishman" (2076); dam, "Ethelinda" (3356), by "Donald Bain" (978); g. d., "Ruth 2nd" (1783), by "Prince of Wales 2nd" (394); gr. g. d., "Ruth of Tillyfour" (1169), by "Black Prince of Tillyfour" (366); gr. g. g. d., "Beauty of Tillyfour 2nd" (1180).

1146 The Duke of Portland, Welbeck Abbey, Worksop, Nottinghamshire: the *Reserve Number* and *Highly Commended* for "Snowdrift 2nd" (Ayrshire), brown and white; was calved April 6th; bred by Mr. A. Allen, Mumrock, Dalry, Ayrshire; sire, "Sir James of Mumroch" (742); dam, "Snowdrift 1st."

Class 105.—*Heifers of any other breed, calved in the Year* 1885,

1152 William Bruce Greenfield, Beechwood Park, Dunstable: First Prize, 15*l.*, for "Gay Lass 5th" (9975) (Polled Aberdeen or Angus), black; was calved January 15th; bred by himself; sire, "Esau" (2084); dam, "Gay Lass 2nd" (4723), by "Pontiff" (1497); g. d., "Gay Lass" (3511), by "Gainsborough 3rd" (598); gr. g. d., "Rose of Gwynd 2nd" (2599), by "Alford of Gwynd 2nd" (1186); gr. g. g. d., "Rose of Gwynd" (2598), by "Young Alford" (1184).

1154 Clement Stephenson, Balliol College Farm: Second Prize, 10*l.*, for "Pride of Englishman" (10,580) (Aberdeen or Angus), black; was calved July 21st; sire, "Englishman" (2076); dam, "Pride of Aberdeen 16th" (3302), by "Gainsborough 3rd" (598); g. d., "Pride of Mulben 2nd" (2359), by "Lochiel" (723); gr. g. d., "Pride of Mulben" (1919), by "Jim Crow 4th" (352); gr. g. g. d., "Pride of Aberdeen 5th" (1174), by "Bright" (454): and the *Reserve Number* and *Highly Commended* for (1153) "Ruth of Balliol" (10,582) (Aberdeen or Angus), black; was calved March 28th; sire, "Englishman" (2076); dam, "Ethelinda" (3356), by "Donald Bain" (978); g. d. "Ruth 2nd" (1783), by "Prince of Wales 2nd" (394); gr. g. d., "Ruth of Tillyfour" (1169), by "Black Prince of Tillyfour" (366); gr. g. g. d., "Beauty of Tillyfour 2nd" (1180); both bred by himself.

Class 106.—*Dairy Cows, calved previously to or in the Year* 1882, *giving not less than* 18 *quarts of milk per diem, containing not less than* 12 *per cent. of solids (including butter-fat).*

1158 Joseph Phillips, Orton Longueville, Peterborough, Northamptonshire: First Prize, 25*l.*, for "Primrose" (Shorthorn), roan; was calved in 1879; in-milk; calved April 21st, 1886; bred by Mr. Gunnell, Hemingford, Hants. Total quantity of milk, 18 quarts, 1 pint; total solids, 12·11.

Class 107.—*Dairy Cows, calved in the Year* 1883, *giving not less than* 12 *quarts of milk per diem, containing not less than* 12 *per cent. solids (including butter-fat).*

1170 George Gooderham, Monewden, Wickham Market, Suffolk: Second Prize, 15*l.*, for "Star" (Red Polled), red; was calved February 12th; in-milk; calved April 23rd, 1886; bred by Mr. J. Pendle, Rendham, Saxmundham; sire, "Ross." Total quantity of milk, 15 quarts, ½ gill; total solids, 12·33.

SHEEP.

Class 108.—*Leicester Two-Shear Rams.*

1178 Teasdale H. Hutchinson, Manor House, Catterick, Yorkshire: First Prize, 15*l.*, and (1177) Second Prize, 10*l.*; were dropped in March 1884; both bred by himself.

1176 Ernest Francis Jordan, Eastburn, Driffield, Yorkshire: the *Reserve Number;* was dropped in April, 1884; bred by himself.

Class 109.—*Leicester Shearling Rams.*

1184 Teasdale H. Hutchinson, Manor House, Catterick: First Prize, 15*l.*, and (1185) Second Prize, 10*l.*, and (1183) the *Reserve Number* and *Highly Commended;* were dropped in March, 1885; all bred by himself.

Class 110.—*Leicester Ram Lambs—Pens of Three, dropped in* 1886.

1188 Teasdale H. Hutchinson, Manor House, Catterick, Yorkshire: First Prize, 10*l.*; were dropped in March; bred by himself.

1186 Tom Strickland, Thirsk Junction, Thirsk, Yorkshire: Second Prize, 5*l.*, and (1187) the *Reserve Number;* were dropped March 26th; all bred by himself.

Class 111.—*Leicester Shearling Ewes—Pens of Five.*

1191 Ernest Francis Jordan, Eastburn, Driffield, Yorkshire: First Prize, 15*l.*, and (1192) Second Prize, 10*l.*; were dropped in April, 1885; all bred by himself.

Class 112.—*Cotswold Two-Shear Rams.*

1193 Russell Swanwick, Royal Agricultural College Farm, Cirencester, Gloucestershire: First Prize, 15*l.*; was dropped about March 1st, 1884; bred by himself.

1198 Thomas Brown, Marham Hall, Downham Market, Norfolk: Second Prize, 10*l.*; was dropped in February, 1884; bred by himself.

1195 Russell Swanwick, Royal Agricultural College Farm: the *Reserve Number* and *Highly Commended;* was dropped about March 1st, 1884; bred by himself.

Class 113.—*Cotswold Shearling Rams.*

1202 Russell Swanwick, Royal Agricultural College Farm: First Prize, 15*l.*; was dropped about March 1st, 1885; bred by himself.

1209 Thomas Brown, Marham Hall: Second Prize, 10*l.*, and (1212) the *Reserve Number* and *Highly Commended;* were dropped in February, 1885; both bred by himself.

Class 114.—*Cotswold Ram Lambs—Pens of Three, dropped in* 1886.

1219 Thomas and Stephen George Gillett, Kilkenny Farm, Faringdon, Oxfordshire: First Prize, 10*l.*; were dropped in February; bred by themselves.

1218 Russell Swanwick, the Royal Agricultural College Farm: Second Prize, 5*l.*; were dropped after February 10th; bred by himself.

Class 115.—*Cotswold Shearling Ewes—Pens of Five.*

1222 Thomas and Stephen George Gillett, Kilkenny Farm, Faringdon: First Prize, 15*l.*; were dropped in February, 1885; bred by themselves.

Class 116.—*Lincoln Two-Shear Rams.*

1224 Robert Wright, Nocton Heath, Lincoln: First Prize, 15*l.*; was dropped in March, 1884; bred by himself.

1225 Henry Dudding, Riby Grove, Great Grimsby, Lincolnshire: Second Prize, 10*l.*; was dropped about March 15th, 1884; bred by Mr. H. Smith, Cropwell Butler, Nottingham.

Class 117.—*Lincoln Shearling Rams.*

1226 John Pears, Mere, Lincoln: First Prize, 15*l.*; was dropped in February or March, 1885; bred by himself.

1229 Robert Wright, Nocton Heath, Lincoln: Second Prize, 10*l.*, and (1228) the *Reserve Number* and *Highly Commended;* were dropped in March, 1885; both bred by himself.

CLASS 118.—*Lincoln Ram Lambs—Pens of Three dropped in* 1886.

1239 HENRY DUDDING, Riby Grove, Great Grimsby, Lincolnshire: FIRST PRIZE, 10*l.*; were dropped about March 15th; bred by himself.

1238 ROBERT WRIGHT, Nocton Heath, Lincoln: SECOND PRIZE, 5*l.*; were dropped in February or March; bred by himself.

1237 JOHN PEARS, Mere, Lincoln: the *Reserve Number*; were dropped in February; bred by himself.

CLASS 119.—*Lincoln Shearling Ewes—Pens of Five.*

1241 ROBERT WRIGHT, Nocton Heath, Lincoln: FIRST PRIZE, 15*l.*; were dropped in March, 1885; bred by himself.

1243 HENRY DUDDING, Riby Grove, Great Grimsby, Lincolnshire: SECOND PRIZE, 10*l.*; were dropped about March 15th, 1885; bred by himself.

1240 JOHN PEARS, Mere, Lincoln: the *Reserve Number* and *Highly Commended*; were dropped in February or March, 1885; bred by himself.

CLASS 120.—*Other Long-Woolled Two-Shear Rams.*

1247 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court, Tiverton, Devon: FIRST PRIZE, 15*l.*, for his Devon long-wool; was dropped February 25th, 1884; and (1246) SECOND PRIZE, 10*l.*, for his Devon long-wool; was dropped February 28th, 1884; both bred by himself.

1245 CHARLES NORRIS, Motion, Exeter: the *Reserve Number* and *Highly Commended*, for his Devon long-wool; was dropped in February, 1884; bred by himself.

CLASS 121.—*Other Long-Woolled Shearling Rams.*

1255 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court: FIRST PRIZE, 15*l.*, for his Devon long-wool; was dropped March 2nd, 1885; and (1256) SECOND PRIZE, 10*l.*, for his Devon long-wool; was dropped February 28th, 1885; both bred by himself.

1253 ALFRED C. SKINNER, Pound Farm, Bishop's Lydeard, Somersetshire: the *Reserve Number* and *Highly Commended* for "Wells" (Devon long-wool); was dropped about February 1st, 1885; bred by himself.

CLASS 122.—*Other Long-Woolled Ram Lambs—Pens of Three, dropped in* 1886.

1260 CHARLES NORRIS, Motion, Exeter: FIRST PRIZE, 10*l.*, for his Devon long-wool; were dropped in February; bred by himself.

1262 JOHN HEUGH, Mudd Fields, Bedale, Yorkshire: SECOND PRIZE, 5*l.*, for his Wensleydale long-wool; were dropped in February; bred by himself.

1261 ALFRED C. SKINNER, of Bishop's Lydeard, Taunton, Somersetshire: the *Reserve Number* for his Devon long-wool; were dropped about February 1st; bred by himself.

CLASS 123.—*Other Long-Woolled Shearling Ewes—Pens of Five.*

1265 SIR JOHN HEATHCOAT HEATHCOAT-AMORY, Bart., Knightshayes Court, Tiverton, Devonshire: FIRST PRIZE, 15*l.*, for his Devon long-wool; were dropped in February and March, 1885; bred by himself.

1264 CHARLES NORRIS, Motion, Exeter, Devonshire: SECOND PRIZE, 10*l.*; for his Devon long-wool; were dropped in February, 1885; bred by himself.

1263 JAMES PILKINGTON, Swinithwaite Hall, Bedale, Yorkshire: the *Reserve Number* and *Highly Commended* for his Wensleydale long-wool: was dropped in March, 1885; bred by himself.

CLASS 124.—*Oxfordshire Down Two-Shear Rams.*

1273 JOHN TREADWELL, Upper Winchendon, Aylesbury, Buckinghamshire: FIRST PRIZE, 15*l.*, for "Baron Bicester;" was dropped about February, 14th, 1884; sire, "Bicester;" dam, by "Wallis No. 7:" and (1274) SECOND PRIZE, 10*l.*, for "Royal Comet;" was dropped about March 1st, 1884; sire, "Young Comet;" dam by "Young Freeland;" both bred by himself.

1278 FREDERIC STREET, Somersham Park, St. Ives, Huntingdonshire: the *Reserve Number* and *Highly Commended* for "Peterboro;" was dropped about February 14th, 1884: bred by himself.

CLASS 125.—*Oxfordshire Down Shearling Rams.*

1295 JOHN TREADWELL, Upper Winchendon: FIRST PRIZE, 15*l.*, for "No. 18;" was dropped about February 1st, 1885; bred by himself; sire, "Young Freeland;" dam by Mr. Hobb's "No. 6."

1304 A. F. MILTON DRUCE, Fyfield, Abingdon, Berks: SECOND PRIZE, 10*l.*; and (1305) THIRD PRIZE, 5*l.*; were dropped about February 1st, 1885; both bred by himself.

1291 JOHN TREADWELL, Upper Winchendon: the *Reserve Number* and *Highly Commended* for "No. 79;" was dropped about February 14th, 1885; bred by himself; sire, "Shrewsbury Reserve;" dam by "Young Freeland."

CLASS 126.—*Oxfordshire Down Ram Lambs—Pens of Three, dropped in* 1886.

1312 WILLIAM HENRY FOX, Bradwell Grove, Burford, Oxfordshire: FIRST PRIZE, 10*l.*; were dropped in January; bred by himself.

1317 WILLIAM ARKELL, Hatherop, Fairford, Gloucestershire: SECOND PRIZE, 5*l.*; were dropped in January; bred by himself.

1315 ALBERT BRASSEY, Heythrop Park, Chipping Norton, Oxfordshire: the *Reserve Number* and *Commended*; were dropped in February; bred by himself.

CLASS 127.—*Oxfordshire Down Shearling Ewes—Pens of Five.*

1328 THE COUNTESS OF CAMPERDOWN, Weston House, Shipston-on-Stour, Warwickshire: FIRST PRIZE, 15*l.*; were dropped about February 1st, 1885; bred by herself; sire, Mr. Treadwell's "No. 8."

1327 GEORGE ADAMS, Royal Prize Farm, Pidnell, Faringdon, Berkshire: SECOND PRIZE, 10*l.*; were dropped January 25th, 1885; bred by himself; sire, "Fyfield;" dam by "Young Swell."

1325 ALBERT BRASSEY, Heythrop Park: the *Reserve Number* and *Highly Commended*; were dropped in February, 1885; bred by himself.

CLASS 128.—*Shropshire Two-Shear Rams.*

1341 HENRY and ARTHUR BRADBURNE, Pipe Place, Lichfield, Staffordshire: FIRST PRIZE, 15*l.*, for "The Dean" (2356); was dropped in February, 1884; bred by themselves; sire, "The Rector" (1769); dam by "Lord Aston" (123).

1329 JOSEPH PULLEY, Lower Eaton, Hereford: SECOND PRIZE, 10*l.*, for "Gladstone" (2057); was dropped about March 11th, 1884; bred by himself; sire, "Touchstone" (1775); dam by "Young Colossus" (1301).

1331 THOMAS STEPHEN MINTON, Montford, Montford Bridge, Shropshire: THIRD PRIZE, 5*l.*; was dropped about March, 1884; bred by himself.

1340 HENRY and ARTHUR BRADBURNE, Pipe Place, Lichfield: the *Reserve Number* and *Highly Commended* for "Sir Tonman;" was dropped about February, 1884; bred by Mr. Richard Thomas, The Buildings, Baschurch, Salop.

CLASS 129.—*Shropshire Shearling Rams.*

1394 MRS. BARRS, Odstone Hall, Atherstone: FIRST PRIZE, 15*l.*, and (1395) SECOND PRIZE, 10*l.*; were dropped about first week in March, 1885; both bred by herself.

1386 JOSEPH BEACH, The Hattons, Brewood, Staffordshire: THIRD PRIZE, 5*l.*; was dropped March 1st, 1885; bred by himself.

1361 MATTHEW WILLIAMS, Bishton Hall, Shifnal, Salop: the *Reserve Number* and *Highly Commended;* was dropped in February, 1885; bred by himself.

CLASS 130.—*Shropshire Ram Lambs--Pens of Three; dropped in* 1886.

1409 ROBERT LODER, Whittlebury, Towcester, Northamptonshire: FIRST PRIZE, 10*l.*; were dropped March 1st; sire, "Lord Ripon" (2152); dam by "Young Alderman" (1288): and (1410) SECOND PRIZE, 5*l.*; were dropped March 1st; sire, "Lord Ripon" (2152); dam, by "Dudmaston Hero" (165), and "Earl of Leicester" (171); all bred by himself.

1413 RICHARD THOMAS, The Buildings, Baschurch, Shropshire: the *Reserve Number* and *Highly Commended;* were dropped in March; bred by himself.

CLASS 131.—*Shropshire Shearling Ewes—Pens of Five.*

1417 PHILIP ALBERT MUNTZ, Dunsmore, Rugby, Warwickshire: FIRST PRIZE, 15*l.*; were dropped in March, 1885; bred by himself; sire, "Latimer Wonder" (703) and "Dunsmore the First" (2009).

1416 THOMAS STEPHEN MINTON, Montford, Montford Bridge, Shropshire: SECOND PRIZE, 10*l.*; were dropped in February and March, 1885; bred by himself.

1422 JOHN DARLING, Beau Desert, Rugeley, Staffordshire: THIRD PRIZE, 5*l.*; were dropped about the end of March, 1885; bred by himself; sire, "Rector" and "Judge;" dam by "Dudmaston Hero" and "Bristol Duke."

1419 ROBERT MILLINGTON KNOWLES, Colston Bassett Hall, Bingham, Nottinghamshire: the *Reserve Number* and *Highly Commended;* were dropped in March 1885; bred by himself.

Class 132.—*Southdown Two-Shear Rams.*

1439 Hugh Gorringe, Kingston-on-Sea, Brighton, Sussex: First Prize, 15*l.*; was dropped in February, 1884; bred by himself.

1443 Jeremiah James Colman, M.P., Carrow House, Norwich: Second Prize, 10*l.*; was dropped in March, 1884; bred by himself.

1430 The Duke of Richmond and Gordon, K.G., Goodwood, Chichester: Third Prize, 5*l.*; was dropped in February, 1884; bred by himself.

1447 Henry Humphrey, Ashington Mills, Pulborough, Sussex: the *Reserve Number* and *Commended;* was dropped in March, 1884; bred by himself.

Class 133.—*Southdown Shearling Rams.*

1476 Hugh Gorringe, Kingston-by-Sea, Brighton: First Prize, 15*l.*, and (1478) Second Prize, 10*l.*; were dropped in February, 1885; both bred by himself.

1482 Jeremiah James Colman, M.P., Carrow House, Norwich: Third Prize, 5*l.*; was dropped March 18th, 1885; bred by himself.

1469 Sir William Throckmorton, Bart., Buckland, Faringdon, Berkshire: the *Reserve Number* and *Highly Commended;* was dropped February 18th, 1885; bred by himself.

Class 134.—*Southdown Ram Lambs—Pens of Three, dropped in* 1886.

1509 Jeremiah James Colman, M.P., Carrow House, Norwich: First Prize, 10*l.*; were dropped in March; bred by himself.

1497 H.R.H. The Prince of Wales, K.G., Sandringham: Second Prize, 5*l.*; were dropped in March; bred by His Royal Highness.

1507 Edwin Ellis, Summersbury, Shalford, Guildford, Surrey: the *Reserve Number* and *Highly Commended*; were dropped in February; bred by himself.

Class 135.—*Southdown Shearling Ewes—Pens of Five.*

1518 Sir William Throckmorton, Bart., Buckland, Faringdon, Berkshire: First Prize, 15*l.*; were dropped in February, 1885; bred by himself.

1516 George Jonas, Ickleton, Great Chesterford, Essex: Second Prize, 10*l.*; were dropped in February, 1885; bred by himself.

1517 The Duke of Hamilton and Brandon, K.T., of Easton Park, Wickham Market, Suffolk: Third Prize, 5*l.*; were dropped in March, 1885; bred by himself.

1514 The Duke of Richmond and Gordon, K.G., of Goodwood, Chichester, Sussex: the *Reserve Number* and *Highly Commended;* were dropped in February, 1885; bred by himself.

Class 136.—*Southdown Ewe Lambs—Pens of Five.**

1536 Jeremiah James Colman, M.P., Carrow House, Norwich: First Prize, 10*l.*; were dropped in March; bred by himself.

1527 T. and F. Botting, Guildford, Surrey: Second Prize, 5*l.*; were dropped February 2nd; bred by themselves.

1535 Edwin Ellis, of Summersbury, Shalford, Guildford, Surrey: Third Prize, 3*l.*; were dropped about March 1st; bred by himself.

1529 GEORGE JONAS, Ickleton, Great Chesterford, Essex: the *Reserve Number* and *Highly Commended;* were dropped in February; bred by himself.

CLASS 137.—*Hampshire Down Two-Shear Rams.*

1544 HENRY LAMBERT, Babraham, Cambridge: FIRST PRIZE, 15*l.*; was dropped in January, 1884; bred by himself: and (1545) SECOND PRIZE, 10*l.*; was dropped in January, 1884; bred by Mr. A. Morrison, Fonthill House, Tisbury, Wiltshire.

1542 FRANK R. MOORE, Littlecott, Upavon, Marlborough, Wilts: *Commended;* was dropped in January, 1884; bred by himself.

CLASS 138.—*Hampshire Down Shearling Rams.*

1553 THOMAS FOWELL BUXTON, Waters Place Farm, Ware, Hertfordshire: FIRST PRIZE, 15*l.*; was dropped January 30th, 1885; bred by himself.

1547 FRANK R. MOORE, Littlecott, Upavon, Marlborough, Wilts: SECOND PRIZE, 10*l.*; was dropped in January, 1885; bred by himself.

1550 HENRY LAMBERT, Babraham, Cambridge: THIRD PRIZE, 5*l.*; was dropped in January, 1885; bred by himself.

1548 FRANK R. MOORE, Littlecott: *Commended;* was dropped in January, 1885; bred by himself.

CLASS 139.—*Hampshire Down Ram Lambs—Pens of Three, dropped in* 1886.

1561 FRANK R. MOORE, Littlecott, Upavon, Marlborough, Wilts: FIRST PRIZE, 10*l.*: and (1562) SECOND PRIZE, 5*l.*; were dropped in January; all bred by himself.

1565 THOMAS FOWELL BUXTON, Waters Place Farm, Ware, Hertfordshire: *Highly Commended;* were dropped in February; bred by himself.

CLASS 140.—*Hampshire Down Shearling Ewes—Pens of Five.*

1570 HENRY PERRY-KEENE, Rowfant, Crawley, Sussex: FIRST PRIZE, 15*l.*; were dropped about February 20th, 1885; bred by the late Sir C. M. Lampson, Bart., Rowfant, Crawley, Sussex.

1573 HENRY SPACKMAN, Bloomfield House, Bath: SECOND PRIZE, 10*l.*; were dropped in February, 1885; bred by himself.

CLASS 141.—*Suffolk Two-Shear Rams.*

1577 EDWARD GITTUS, Snailwell, Newmarket, Cambridgeshire: FIRST PRIZE, 15*l.*, for "Young Sampson;" was dropped in February, 1884; bred by himself.

1576 JOSEPH SMITH, Thorpe Hall, Hasketon, Woodbridge, Suffolk: SECOND PRIZE, 10*l.*, for "Bismarck 3rd;" was dropped February 3rd, 1884; bred by himself; sire, "Bismarck 2nd."

CLASS 142.—*Suffolk Shearling Rams.*

1586 THE MARQUESS OF BRISTOL, Ickworth Park, Bury St. Edmunds: FIRST PRIZE, 15*l.*, for "Van Trump 2nd;" was dropped January 10th, 1885; bred by himself; sire, "Van Trump 1st."

1585 EDWARD GITTUS, Snailwell, Newmarket: SECOND PRIZE, 10*l.*; was dropped in February, 1885; bred by himself; sire, "Young Sampson."

1580 GEORGE BENTINCK ROBINS, Moulton, Newmarket: *Highly Commended;* was dropped January 30th, 1885; bred by himself.

CLASS 143.—*Suffolk Ram Lambs—Pens of Three, dropped in* 1886.

1592 JOSEPH SMITH, Thorpe Hall, Hasketon, Woodbridge, Suffolk: FIRST PRIZE, 10*l.*; were dropped February; bred by himself; sire, "Bismarck," and "Jack."

1587 GEORGE BENTINCK ROBINS, French Hall, Moulton, Newmarket: SECOND PRIZE, 5*l.*; were dropped in January and February; bred by himself.

CLASS 144.—*Suffolk Shearling Ewes—Pens of Five.*

1601 EDWARD GITTUS, Snailwell, Newmarket: FIRST PRIZE, 15*l.*; were dropped in February, 1885; bred by himself.

1600 JOSEPH SMITH, Thorpe Hall: SECOND PRIZE, 10*l.*; were dropped in February, 1885; bred by himself; sire, "Bismarck," and "Jack"

1598 GEORGE BENTICK ROBINS, French Hall: *Highly Commended;* were dropped in January and February, 1885; bred by himself.

CLASS 145.—*Suffolk Ewe Lambs—Pens of Five.*†

1603 GEORGE BENTINCK ROBINS, French Hall, Moulton, Newmarket: FIRST PRIZE, 10*l.*; were dropped in January and February; bred by himself.

1608 THE MARQUESS OF BRISTOL, Ickworth Park, Bury St. Edmunds: SECOND PRIZE, 5*l.*; were dropped in January; bred by himself; sire, "Van Trump 1st" and "Van Trump 2nd."

1607 EDWARD GITTUS, Snailwell, Newmarket: THIRD PRIZE, 3*l.*; were dropped in February; bred by himself.

1606 JOSEPH SMITH, Thorpe Hall, Hasketon, Woodbridge: *Highly Commended;* were dropped in February; bred by himself; sire, "Bismarck," and "Jack."

CLASS 146.—*Other Short-woolled Two-Shear Rams.*

1609 FRANK SHEPHERD, The Brook, Colwall, Malvern: FIRST PRIZE, 15*l.*, for his Ryeland; was dropped in March, 1884; bred by himself.

CLASS 147.—*Other Short-woolled Shearling Rams.*

1611 FRANK SHEPHERD, The Brook: FIRST PRIZE, 15*l.*, for his Ryelands; were dropped in March, 1885: (1610) SECOND PRIZE, 10*l.*, for his Ryelands; were dropped March 18th, 1885; all bred by himself.

CLASS 148.—*Other Short-woolled Ram Lambs—Pens of Three, dropped in* 1886.

1613 FRANK SHEPHERD, The Brook: FIRST PRIZE, 10*l.*, for his Ryelands; were dropped in March; bred by himself.

---

† Given by the Suffolk Agricultural Association.

CLASS 149.—*Other Short-woolled Shearling Ewes—Pens of Five.*

1614 SAMUEL KIDNER, Bickley Farm, Milverton, Somersetshire: FIRST PRIZE, 15*l.*, for his Dorset Horns; were dropped in December, 1884; bred by himself.

CLASS 150.—*Cross-bred Lambs—Pens of Five, dropped in* 1886.*

1615 HUBERT SHERINGHAM, South Creak, Fakenham, Norfolk: FIRST PRIZE, 20*l.*; were dropped in January; sire, Cotswold Ram; dam, Hampshire Down Ewes: and (1616) SECOND PRIZE, 10*l.*; were dropped in January; sire, Oxford Down Ram; dam, Hampshire Down Ewes; all bred by himself.

1617 THOMAS RUSH, Chalk Farm, Babraham, Cambridgeshire: THIRD PRIZE, 5*l.*, were dropped February 1st; bred by himself; sire, Hampshire Ram; dam, cross-bred by Cotswold Ram.

PIGS.

CLASS 151.—*Large White Breed—Boars farrowed in the Year* 1885.

1621 WILLIAM HALL, Manor Farm, Belper, Derbyshire: FIRST PRIZE, 10*l.*, for "Dairyman;" was farrowed April 2nd, 1885; bred by himself; sire, "Prince;" dam, "Princess 4th," by "Major."

1623 F. A. WALKER-JONES, Little Mollington, Chester: SECOND PRIZE, 5*l.*; was farrowed January 10th, 1885; bred by himself; sire, "Lieut.-Colonel" (105); dam, "Baroness" (82), by "What's Wanted."

CLASS 152.—*Large White Breed Boar Pigs—Pens of Three, farrowed in the Year* 1886.

1633 WILLIAM HALL, Manor Farm, Belper: FIRST PRIZE, 10*l.*; were farrowed January 3rd; bred by himself; sire, "Prince;" dam, "Countess 4th," by "Champion."

1637 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*; were farrowed January 6th; bred by himself; sire, "Cultivator 30th;" dam by "Joseph 4th."

1635 JAMES HOWARD, Clapham Park, Bedfordshire: the *Reserve Number*; were farrowed January 2nd; bred by himself; sire, "Britannia Wonder;" dam, "Beauty 7th," by "Broadhead."

CLASS 153.—*Large White Breed—Breeding Sows, farrowed previously to or in the Year* 1885.

1643 JAMES HOWARD, Clapham Park: FIRST PRIZE, 10*l.*; "Beauty 4th;" was farrowed October 12th, 1880; in-pig; bred by himself; sire, "Hector;" dam, "Beauty 2nd," by "Liverpool."

1644 CHARLES ELMHIRST DUCKERING, Hibaldstowe Cliff, Kirton Lindsey, Lincolnshire: SECOND PRIZE, 5*l.*; was farrowed June 22nd, 1883; bred by himself.

1646 PHILIP ASCROFT, Rufford, Ormskirk, Lancashire: THIRD PRIZE, 3*l.*, for "Lancashire Lass;" was farrowed July 10th, 1883; bred by himself; sire, "Ben" (59); dam, "Lily," by "Tiger."

1640 F. A. WALKER-JONES, Little Mollington, Chester: the *Reserve Number* and *Highly Commended;* was farrowed July 13th, 1883; bred by himself; sire "Peter;" dam, "Miss Ashmall."

CLASS 154.—*Large White Breed—Breeding Sow Pigs—Pens of Three farrowed in the Year* 1886.

1660 THOMAS COLLINSON, Jun., Shay Farm, Halifax: FIRST PRIZE, 10*l.*, for "Glory," "Gipsy," "Garland," were farrowed January 11th; bred by himself; sire, "Jumbo II.;" dam, "Pretty Maid," by "Bill."

1568 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*; were farrowed January 4th; sire, "Cultivator 30th;" dam by "Joseph 4th:" and (1657) THIRD PRIZE, 3*l.*; were farrowed January 2nd; sire, "General;" dam by "Brutus;" all bred by himself.

1653 F. A. WALKER-JONES, Little Mollington, Chester: the *Reserve Number* and *Highly Commended;* were farrowed January 5th; bred by himself; sire, "Lieut.-Colonel II.;" dam, "Baroness" (82), by "What's Wanted."

CLASS 155.—*Middle White Breed—Boars farrowed in the Year* 1885.

1661 F. A. WALKER-JONES, Little Mollington, Chester: FIRST PRIZE, 10*l.*; was farrowed January 5th; bred by himself; sire, "Punch" (189); dam, "Margery II.," by "Star."

1665 CHARLES ELMHIRST DUCKERING, Hibaldstowe Cliff, Kirton Lindsey, Lincolnshire: SECOND PRIZE, 5*l.*; were farrowed June 20th; bred by Messrs. W. Crosby and Co., Apperley Bridge, Leeds.

1667 EDWARD THOMAS CHALK, Linton, Cambridgeshire: THIRD PRIZE, 3*l.*, for "Pat;" was farrowed in February; bred by Mr. Sanders Spencer, Holywell Manor, St. Ives, Hunts; sire, "Prince;" dam, "My Lass," by "Holywell Samson" (171).

CLASS 156.—*Middle White Breed—Boar Pigs, Pens of Three farrowed in the Year* 1886.

1670 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; were farrowed January 1st; bred by himself; sire, "Boswell;" dam by "Peter."

1668 JOSEPH NUTTALL, Longfield, Heywood, Lancashire: SECOND PRIZE, 5*l.*; were farrowed January 15th; bred by himself.

CLASS 157.—*Middle White Breed—Breeding Sows farrowed previously to or in the Year* 1885.

1680 PHILIP ASCROFT, Rufford, Ormskirk, Lancashire: FIRST PRIZE, 10*l.*; was farrowed January 27th, 1884; bred by himself: (1681) SECOND PRIZE, 5*l.*; was farrowed December 26th, 1882; bred by Mr. G. Lewis, Ercall Park, Wellington, Shropshire: and (1679) THIRD PRIZE, 3*l.*, for "Kitty;" was farrowed August 1st, 1883; bred by himself; sire, "Peter" (185); dam, "Borrower," by "Jack."

1672 EDWARD HENRY TOULMIN, The Warren, Wotton-under-Edge: the *Reserve Number* and *Highly Commended* for "Sabrina III.;" was farrowed April 30th, 1884; bred by Mr. Twentyman, Castlecroft, Wolverhampton; dam, "Sabrina II."

CLASS 158.—*Middle White Breed—Breeding Sow Pigs, Pens of Three, farrowed in the Year* 1886.

1687 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; were farrowed January 26th; bred by himself; sire, "Boswell;" dam by "Peter."

1688 RICHARD EDWARDS, Combe Farm, Presteign, Radnorshire: SECOND PRIZE, 5*l.*; were farrowed February 5th; bred by himself; sire, "Sloper;" dam, "Slut," by "Holywell."

1691 THE AYLESBURY DAIRY COMPANY (Limited), Horsham, Sussex: THIRD PRIZE, 3*l.*; were farrowed January 28th; sire, "Billie;" dam, "White Daisy," by "Sampson:" and (1690) the *Reserve Number;* were farrowed January 28th; sire, "Billie;" dam, "White Daisy," by "Samson;" all bred by Lieut.-Colonel H. Platt, Gorddinog, Bangor, Carnarvonshire.

CLASS 159.—*Small White Breed—Boars farrowed in the Year* 1885.

1694 LORD MORETON, Tortworth Court, Falfield, Gloucestershire: FIRST PRIZE, 10*l.*; was farrowed March 10th; bred by himself; sire, "Linet;" dam, "Lady Bridgewater," by "Uncle Tom" (251).

1697 THE EARL OF ELLESMERE, Worsley Hall, Manchester: SECOND PRIZE, 5*l.*; was farrowed August 5th; bred by himself; sire, "Hero;" dam by "The Swell."

1692 ADOLPHUS H. SLADE, Castle Hill, Addington, Croydon, Surrey: the *Reserve Number* and *Highly Commended* for "Jim;" was farrowed October 16th; bred by himself; sire, "Buckland;" dam, "Beauty," by "Warwick."

CLASS 160.—*Small White Breed—Boar Pigs, Pens of Three, farrowed in the Year* 1886.

1699 THE EARL OF RADNOR, Coleshill House, Highworth, Wilts: FIRST PRIZE, 10*l.*; were farrowed January 3rd; bred by himself; sire, "Jumbo;" dam, "Grace," by "Lord Derby."

CLASS 161.—*Small White Breed—Breeding Sows farrowed previously to or in the Year* 1885.

1711 THE EARL OF ELLESMERE, Worsley Hall, Manchester: FIRST PRIZE, 10*l.*; was farrowed November 5th, 1883; sire, "The Swell;" dam by "King Koffee:" and (1712) SECOND PRIZE, 5*l.*; was farrowed March 3rd, 1884; sire, "The Swell;" dam by "True Mold;" both bred by himself.

1705 LORD MORETON, Tortworth Court, Falfield, Gloucestershire: THIRD PRIZE, 3*l.*, for "Lady Preston;" was farrowed July 1st, 1884; in-pig; bred by himself; sire, "Linet;" dam, "Lady Bridgewater," by "Uncle Tom" (251).

1708 F. A. WALKER-JONES, Little Mollington, Chester: the *Reserve Number* and *Highly Commended;* was farrowed November 21st, 1884; bred by himself; sire, "Roger;" dam, "Snowdrop" (264), by "Curly."

CLASS 162.—*Small White Breed—Breeding Sow Pigs, Pens of Three, farrowed in the Year* 1886.

1715 THE EARL OF RADNOR, Coleshill House, Highworth, Wiltshire: FIRST PRIZE, 10*l.*; were farrowed January 3rd; bred by himself; sire, "Jumbo;" dam, "Gipsy 2nd," by "Lord Derby."

1716 LORD MORETON, Tortworth Court, Falfield: SECOND PRIZE, 5*l.*; were farrowed January 2nd; bred by himself; sire, "Islington;" dam, "Lady Bridgewater," by "Uncle Tom" (251).

CLASS 163.—*Small Black Breed—Boars farrowed in the Year* 1885.

1718 GEORGE PETTIT, The Firs, Friston, Saxmundham, Suffolk: FIRST PRIZE, 10*l.*; for "Prince;" was farrowed May 27th; sire, "Danger;" dam, "Victoria:" and (1717) SECOND PRIZE, 5*l.*, for "Go-ahead;" was farrowed May 27th; sire, "Danger;" dam, "Victoria;" both bred by himself.

1720 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: the *Reserve Number* for "Peter;" was farrowed August 2nd; bred by himself; sire, "Prince;" dam, "Jet," by "Doncaster."

CLASS 164.—*Small Black Breed—Boar Pigs, Pens of Three, farrowed in the Year* 1886.

1730 JOSEPH ALFRED SMITH, Rise Hall, Akenham, Ipswich, Suffolk: FIRST PRIZE, 10*l.*, for "Rose," "Shamrock," "Thistle;" were farrowed January 3rd; bred by himself; sire, "Playford;" dam, "Melton."

1727 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market: SECOND PRIZE, 5*l.*; were farrowed January 5th; bred by himself; sire, "Prince;" dam, "Countess," by "Robert the Devil."

1726 GEORGE PETTIT, The Firs, Friston, Saxmundham, Suffolk: the *Reserve Number* and *Commended;* were farrowed January 20th; bred by himself; sire, "Danger;" dam, "Lucy."

CLASS 165.—*Small White Breed—Breeding Sows farrowed previously to or in the Year* 1885.

1742 CHARLES ELMHIRST DUCKERING, Hibaldstowe Cliff, Kirton-in-Lindsay, Lincolnshire: FIRST PRIZE, 10*l.*; was farrowed June 21st, 1884; bred by himself.

1732 GEORGE PETTIT, The Firs, Friston: SECOND PRIZE, 5*l.*; was farrowed March 3rd, 1885; in-pig; bred by himself; sire, "Negro;" dam, "Nancy."

1737 THE DUKE OF HAMILTON AND BRANDON, K.T., Easton Park, Wickham Market, Suffolk: THIRD PRIZE, 3*l.*, for "Pride;" was farrowed January 22nd, 1885; in-pig; bred by himself; sire, "Robert the Devil;" dam, "Jet II.," by "Sam."

1733 GEORGE PETTIT, The Firs: the *Reserve Number* and *Highly Commended;* was farrowed May 27th, 1885; in-pig; bred by himself; sire, "Danger;" dam, "Victoria."

Class 166.—*Small White Breed—Breeding Sow Pigs—Pens of Three farrowed in the Year* 1886.

1744 The Rev. William Hooper, Chilfrome Rectory, Dorchester: First Prize, 10*l.*; were farrowed January 5th; bred by himself; sire, "Gipsy King;" dam, "Lady Sutton," by "Lord Salisbury."

1743 George Pettit, The Firs, Friston, Saxmundham: Second Prize, 5*l.*; were farrowed January 20th; bred by himself; sire, "Danger;" dam, "Lucy."

1746 Henry Charles Bliss Gilbert, Braydestone Hall, Blofield, Norfolk: the *Reserve Number;* were farrowed January 5th; bred by himself; sire, "Great Mogul;" dam, "St. Marguerite."

Class 167.—*Berkshire Breed—Boars, farrowed in the Year* 1885.

1752 Gaius Follett Vincent, Compton Vallence, Dorchester: First Prize, 10*l.*, for "Tinker 2nd;" was farrowed January 5th; bred by himself; sire, "Tinker;" dam, "Princess 2nd" (246), by "Warwick 1st."

1761 Alfred E. W. Darby, Little Ness, Shrewsbury: Second Prize, 5*l.*, for "Pilot;" was farrowed June 1st; bred by himself; sire, "Speculation;" dam, "Peeress," by "Latimer."

1754 Russell Swanwick, Royal Agricultural College Farm, Cirencester, Gloucestershire: Third Prize, 3*l.*; was farrowed November 3rd; bred by himself; sire, "Artful Joe;" dam, "First Choice," by "Gloucester 3rd."

1760 Alfred E. W. Darby, Little Ness: the *Reserve Number* and *Commended* for "Adcote Lad;" was farrowed January 5th; bred by himself; sire, "Speculation;" dam, "Shrewsbury Maid," by "Jumbo."

Class 168.—*Berkshire Breed—Boar Pigs—Pens of Three, farrowed in the Year* 1886.

1766 Russell Swanwick, Royal Agricultural College Farm, Cirencester: First Prize, 10*l.*; were farrowed January 4th; bred by himself; sire, "Wicket Keeper;" dam, "Sally" (117), by "Colonel."

1764 Hamon Le Strange, Hunstanton Hall, King's Lynn, Norfolk: Second Prize, 5*l.*; were farrowed February 22nd; bred by himself; sire, "Blacksmith;" dam, "Franchise."

1768 The Executors of the late Arthur Stewart, Saint Bridge Farm, Gloucester: Third Prize, 3*l.*; were farrowed January 5th; bred by themselves; sire, "Challenge" (124); dam, "Busybody" (195), by "King Birt."

1769 Arthur S. Gibson, Springhill, Bulwell, Nottinghamshire: the *Reserve Number;* were farrowed January 25th; bred by himself; sire, "Grandee:" dam, "Emblem," by "Exor."

Class 169.—*Berkshire Breed—Breeding Sows farrowed previously to or in the Year* 1885.

1783 Alfred E. W. Darby, Little Ness, Shrewsbury: First Prize, 10*l.*, for "Portia;" was farrowed January 11th, 1885; in-pig; bred by himself; sire, "Speculation;" dam, "Pandora," by "Lord Conyers."

1776 Gaius Follett Vincent, Compton Vallence, Dorchester: Second Prize, 5*l.*, for "Black Bess 2nd;" was farrowed January 19th, 1885; in-pig; bred by himself; sire, "Prince" (247); dam, "Black Bess" (244), by "Warwick 1st."

1773 Major Peploe, Garnstone, Weobley, Herefordshire: Third Prize, 3*l.*, for "Cora;" was farrowed February 10th, 1885; in-pig; bred by himself; sire, "Paragon;" dam, "Sister B. I.," by "Soporific."

1788 Nathaniel Benjafield, Short Green Farm, Motcombe, Shaftesbury, Dorsetshire: the *Reserve Number* and *Highly Commended* for "Juliet;" was farrowed June 2nd, 1884; in-pig; bred by himself; sire, "Beaconsfield;" dam, "Shotover," by "Rubstone."

Class 170.—*Berkshire Breed—Breeding Sow Pigs, Pens of Three farrowed in the Year* 1886.

1793 Gaius Follett Vincent, Compton Valence, Dorchester: First Prize, 10*l.*: were farrowed January 2nd; bred by himself; sire, "Prince" (247); dam, "Black Bess" (244), by "Warwick 1st."

1801 Louis Ponsonby, Terrick, Tring: Second Prize, 5*l.*, for "Three Penelopes;" were farrowed January 4th; bred by himself; sire, "Royal Duke;" dam, "Penelope," by "Lord Conyers."

1800 Nathaniel Benjafield, Short's Green Farm, Shaftesbury, Dorsetshire: Third Prize, 3*l.*; were farrowed January 5th; bred by himself; dam, "Shotover II.," by "Hotspur II."

1795 Russell Swanwick, Royal Agricultural College Farm, Cirencester: the *Reserve Number* and *Commended;* were farrowed January 5th; bred by himself; sire, "Dorchester;" dam, "Sally" (210), by "Artful Joe."

Class 171.—*Tamworth Breed—Boars farrowed in the Year* 1885.

1806 The Aylesbury Dairy Company (Limited), of Horsham, Sussex: "Wallace;" was farrowed August 18th; bred by themselves; sire, "Peeping Tom;" dam, "Tamworth Lady," by "St. Lubbock."

1803 J. and W. H. Mitchell, Springfield Farm, Hall Green, Birmingham: Second Prize, 5*l.*, for "Solomon;" was farrowed June 14th; bred by themselves; sire, "Samson;" dam, "Sylvia."

1805 The Aylesbury Dairy Company (Limited), Horsham: the *Reserve Number* for "Nelson;" was farrowed August 18th; bred by themselves; sire, "Peeping Tom;" dam, "Tamworth Lady," by "St. Lubbock."

Class 172.—*Tamworth Breed—Boar Pigs—Pens of Three farrowed in the Year* 1886.

1808 John Norman, Jun., Cliff House, Tamworth: First Prize, 10*l.*; were farrowed January 17th; bred by himself; sire, "William the Conqueror;" dam, "Duchess."

Class 173.—*Tamworth Breed—Breeding Sows farrowed previously to or in the Year* 1885.

1818 The Aylesbury Dairy Company (Limited), Horsham, Sussex; First Prize, 10*l.*, for "Lady Foster 2nd;" was farrowed August 8th, 1884; sire, "The Peeler;" dam, "Lady Foster," by "St. Lubbock:"

(1819) Second Prize, 5*l.*, for "Tamworth Lady;" was farrowed July 20th, 1884; in-pig; sire, "St. Lubbock;" dam, "Tamworth Lass:" and (1820) the *Reserve Number* for "Lady Foster;" was farrowed August 11th, 1883; sire, "St. Lubbock;" dam, "Tamworth Lass;" all bred by G. M. Allender, Stammerham, Horsham.

Class 174.—*Tamworth Breed—Breeding Sow Pigs—Pens of Three, farrowed in the Year* 1886.

1823 The Aylesbury Dairy Company: First Prize, 10*l.*; were farrowed January 20th; bred by themselves; sire, "Peeping Tom;" dam, "Lady Foster 2nd," by "The Peeler."

1821 John Norman, Jun., Cliff House, Tamworth: Second Prize, 5*l.*; were farrowed January 17th; bred by himself; sire, "William the Conqueror;" dam, "Duchess."

1822 J. and W. H. Mitchell, Springfield Farm, Hall Green, Birmingnam: the *Reserve Number*; were farrowed February 9th; bred by themselves; sire, "Samuel."

CHEESE.

Class 175.—*Three Cheddar, not less than* 50 *lbs., and not exceeding* 80 *lbs. each, made in the Year* 1885.

3 Henry Cannon, Little Burton, Sherborne, Dorset: First Prize, 10*l.*

1 Thomas Allen, Crookwood Farm, Devizes, Wilts: Second Prize, 5*l.*

2 Theodore C. Candy, Woolcombe, Cattistock, Dorchester: the *Reserve Number.*

Class 176.—*Three Cheddar, not less than* 50 *lbs., and not exceeding* 80 *lbs. each, made in the Year* 1886.

8 Robert G. Norman, Chetnole Manor Farm, Sherborne, Dorset: First Prize, 10*l.*

6 Thomas Allen, Crookwood: Second Prize, 5*l.*

7 William Corp, Clanville, Castle Cary, Somerset: the *Reserve Number.*

Class 177.—*Three Cheshire, above* 30 *lbs., and not exceeding* 100 *lbs. each, made in the Year* 1885.

9 John Lee, Halghton Hall, Wrexham, North Wales: First Prize, 10*l.*

Class 178.—*Three Cheshire, above* 30 *lbs., and not exceeding* 100 *lbs. each, made in the Year* 1886.

11 William Cookson, Alpraham Hall, Tarporley, Cheshire: First Prize, 10*l.*

13 John Lee, Halghton Hall: Second Prize, 5*l.*

10 James Blake, Stretton Lower Hall, Malpas, Cheshire: the *Reserve Number.*

Class 179.—*Six Stilton, made in the Year* 1885.

15 Charles Goodson, Dairy Farm, Great Dalby, Melton Mowbray, Leicestershire: First Prize, 10*l*.

16 Henry Morris, Manor Farm, Saxelby, Melton Mowbray: Second Prize, 5*l*.

Class 180.—*Six Stilton, made in the Year* 1886.

17 Charles Goodson, Dairy Farm, Great Dalby: First Prize, 10*l*.

18 Henry Morris, Manor Farm, Saxelby: Second Prize, 5*l*.

Class 181.—*Three Derbyshire, made in the Year* 1886.

23 Henry Prince, Eaton Doveridge, Derby: First Prize, 10*l*.

21 John Gould, Bridge End, Hartington, Ashbourne, Derbyshire: Second Prize, 5*l*.

20 John Blunt, Breedon-on-the-Hill, Ashby-de-la-Zouch, Leicestershire: the *Reserve Number* and *Highly Commended.*

Class 182.—*Three Double-Gloucester, made in the Year* 1886.

26 George Harris, Court House Farm, Cam, Dursley, Gloucestershire: First Prize, 10*l*.

Class 183.—*Three Factory-made Cheeses, made in the Year* 1886.

31 John Platts, Belle Vue, Wem, Salop: First Prize, 10*l*.

28 The Aston-by-Budworth Cheese Dairy Company, Northwich, Cheshire: Second Prize, 5*l*.

30 John Gould, Bridge End, Hartington: the *Reserve Number.*

Class 184.—*Six English Soft Cheeses, made in the Year* 1886.

34 Mrs. Mitchell, The Vale, Kirby Bedon, Trowse, Norfolk: First Prize, 10*l*.

33 James Long, Graveley Manor, Stevenage, Herts: Second Prize, 5*l*.

BUTTER.

Class 185.—*Six Pounds of Fresh Butter, absolutely free from Salt, made up in pounds or half-pounds.*

8 Richard Colley, Sylfam, Welshpool, Montgomeryshire: First Prize, 5*l*.

22 John Swan, Stonefield, Lincoln: Second Prize, 3*l*.

11 George Dodge, Moat House, Steeple Claydon, Winslow, Buckinghamshire: Third Prize, 2*l*.

18 Mrs. Mitchell, The Vale, Kirby Bedon, Trowse, Norfolk: Fourth Prize, 1*l*.

23 Ross M. Tanner, Woolbeding, Midhurst, Sussex: the *Reserve Number* and *Highly Commended.*

Class 186.—*Six Pounds of Butter, slightly Salted, made up in pounds or half-pounds.*

55 The Rev. W. F. Thursby, Burgh Apton Rectory, Norwich: First Prize, 5*l.*

35 Sir E. Birkbeck, Bart., Horstead Hall, Norwich: Second Prize, 3*l.*

52 John Swan, Stonefield, Lincoln: Third Prize, 2*l.*

46 Lord Hastings, Melton Constable, East Dereham, Norfolk: Fourth Prize, 1*l.*

37 Richard J. Clarke, Lingwood Lodge, Norwich: the *Reserve Number* and *Highly Commended.*

Class 187.—*One Keg or other package of Salt Butter, not less than* 14 *lbs. in weight.*

66 Thomas Davies, Pont-faen Farm, Rhuddlan, Flintshire: Second Prize, 5*l.*

72 Ross M. Tanner, Woolbeding, Midhurst: the *Reserve Number.*

HIVES, HONEY, &c.

Prizes given by the British Bee-Keepers' Association.

Class 188.—*Frame Hives for general use in an Apiary. Price not to exceed* 15*s. unpainted.*

15 G. Neighbour and Son, 149, Regent Street, London: First Prize, 1*l.*

8 J. Dines and Son, Malden, Essex: Second Prize, 15*s.*

16 G. Neighbour and Son: Third Prize, 10*s.*

Class 189.—*Frame Hives for Cottagers' use. Price not to exceed* 10*s.* 6*d., unpainted.*

34 G. Neighbour and Son: First Prize, 1*l.*

26 J Dines and Son, Maldon: Second Prize, 10*s.*

22 A. T. Adams, Crick, Rugby: Third Prize, 5*s.*

Class 190.—*Crates filled with Sections. Price not to exceed* 3*s.* 6*d.*

44 J. Dines and Son, Malden: First Prize, 15*s.*

47 Howard and Meadows, Holme, Peterborough: Second Prize, 10*s.*

37 Abbott Brothers, Southall, Middlesex: Third Prize, 5*s.*

Class 191.—*Supers of Honey (not being Sectional).*

65 W. Woodley, World's End, Newbury: First Prize, 1*l.*

59 John Laurence, New Buckenham, Attleborough: Second Prize, 10*s.*

55 R. R. Godfrey, Grantham: Third Prize, 5*s.*

CLASS 192.—*Twelve 2-lb. Sections of Comb Honey.*

67 HENRY BESWICK, Long Stratton, Norfolk: FIRST PRIZE, 1*l.*

67 THE BEE AND FRUIT FARMING CO., Hockenden, St. Mary's Cray, Kent: SECOND PRIZE, 10*s.*

68 MISS MARY L. GAYTON, Much Hadham, Ware: THIRD PRIZE, 5*s.*

CLASS 193.—*Twelve 1-lb. Sections of Comb Honey.*

83 HENRY BESWICK, Long Stratton: FIRST PRIZE, 1*l.*

90 JOHN H. HOWARD, Holme, Peterborough: SECOND PRIZE, 10*s.*; and (91) THIRD PRIZE, 5*s.*

CLASS 194.—*Run or Extracted Honey, in 2-lb. glass jars.*

114 MISS M. L. GAYTON, Much Hadham: FIRST PRIZE, 15*s.*

112 F. T. CHEVALLIER, Bungay: SECOND PRIZE, 10*s.*

119 A. KENDLE, Weasenham, Swaffham: THIRD PRIZE, 5*s.*

CLASS 195.—*Run or Extracted Honey, in 1-lb. glass jars.*

131 F. T. CHEVALLIER: FIRST PRIZE, 15*s.*

CLASS 196.—*Samples of Comb Foundation.*

156 S. J. BALDWIN, Bromley, Kent: FIRST PRIZE, 1*l.*

157 JOHN H. HOWARD, Holme: SECOND PRIZE, 10*s.*

CLASS 197.—*Collections of Hives and Bee Furniture.*

163 G. NEIGHBOUR AND SON, 149, Regent Street, London: FIRST PRIZE, 2*l.*

162 HOWARD AND MEADOWS, Holme, Peterborough: SECOND PRIZE, 1*l.* 10*s.*

POULTRY.

By "Cocks," "Hens," "Drakes," "Ducks," "Ganders," and "Geese," are meant birds hatched previous to January 1st, 1885, and by "Cockerels," "Pullets," "Young Drakes," "Ducklings," "Young Ganders," and "Goslings," are meant birds hatched in 1885, previous to June 1st.

FOWLS.

CLASS 1.—*Dark Brahma Cock and Three Hens.*

1 GEORGE B. COOPER BREEZE, Butler's Green, Ware, Hertfordshire: FIRST PRIZE, 3*l.*

5 S. W. THOMAS, Glasfryn, Cockett, Swansea, S. Wales: SECOND PRIZE, 2*l.*

3 RECHAB HOLLAND, Brahma Road, Buckingham: THIRD PRIZE, 1*l.*: and (2) the *Reserve Number.*

Class 2.—*Dark Brahma Cockerel and Three Pullets.*

10 Charles Davenport Jones, Bryn-y-mor, Hastings: First Prize, 3*l.*
7 George B. Cooper Breeze: Second Prize, 2*l.*
8 Rechab Holland: Third Prize, 1*l.*: and (9) the *Reserve Number.*

Class 3.—*Light Brahma Cock and Three Hens.*

11 George B. Cooper Breeze: First Prize, 3*l.*
12 Robert Butterfield, Nafferton Hall, Hull: Second Prize, 2*l.*

Class 4.—*Light Brahma Cockerel and Three Pullets.*

16 Robert Butterfield: First Prize, 3*l.*
15 Rev. Harold Burton, Fauls Vicarage, Whitchurch, Salop: Second Prize, 2*l.*
14 George Cooper Breeze: Third Prize, 1*l.*

Class 5.—*Cochin Cock and Three Hens (any variety).*

20 George Henderson Procter, Flass House, Durham: First Prize, 3*l.*
19 Mrs. H. J. Goodall, The Priory, Melton Mowbray: Second Prize, 2*l.*
18 Alfred E. W. Darby, Little Ness, Shrewsbury: Third Prize, 1*l.*

Class 6.—*Cochin Cockerel and Three Pullets (any variety).*

24 Mrs. H. J. Goodall: First Prize, 3*l.*
26 Mrs. M. Scriven, Normandy Villa, Shipley, Yorks: Second Prize, 2*l.*
23 Robert R. Fowler, Prebendal Poultry Farms, Aylesbury: Third Prize, 1*l.*
25 George Henderson Procter: the *Reserve Number* and *Highly Commended.*

Class 7.—*Langshan Cock and Three Hens.*

27 Rev. Arthur C. Davies, Aldborough Rectory, Hanworth, Norwich: First Prize, 3*l.*
32 Henry Merton Orme, Lutwicke, Slinfold, Horsham, Sussex: Second Prize, 2*l.*
28 Rev. Arthur C. Davies: Third Prize, 1*l.*
31 Messrs. Oliver and Nunn, Southgate Green, Bury St. Edmunds: the *Reserve Number.*

Class 8.—*Langshan Cockerel and Three Pullets.*

36 Henry Merton Orme: First Prize, 3*l.*
34 Charles A. Abraham, Risby Rectory, Bury St. Edmunds: Second Prize, 2*l.*

Class 9.—*Houdan Cock and Three Hens.*

38 Miss M. L. Clayton, Wilmslow, Cheshire: First Prize, 3*l.*
39 P. Hanson, Old Windsor, Berkshire: Second Prize, 2*l.*

40 S. W. Thomas, Glasfryn, Cockett, Swansea: Third Prize, 1*l.*

37 John T. Calvert, 6, Park Street, Keighley, Yorkshire: the *Reserve Number* and *Highly Commended.*

Class 10.—*Houdan Cockerel and Three Pullets.*

42 W. Oliver Quibell, Highfield, Newark, Nottinghamshire: First Prize, 3*l.*

41 P. Hanson: Second Prize, 2*l.*

Class 11.—*Plymouth Rock Cock and Three Hens.*

50 James Holden, Simonstone, Padiham, Burnley, Lancashire: First Prize, 3*l.*

51 James Ollerhead, The Gardens, Wimbledon House, Wimbledon, Surrey: Second Prize, 2*l.*

44 Edward Anderson, Perryfields, Maidstone: Third Prize, 1*l.*

48 John Simpson Gregory, Sandhurst, Wokingham, Berkshire: the *Reserve Number* and *Highly Commended.*

Class 12.—*Plymouth Rock Cockerel and Three Pullets.*

59 John Simpson Gregory: First Prize, 3*l.*

61 James Holden: Second Prize, 2*l.*

65 Christopher Sainty, Ham House, Old Windsor: Third Prize, 1*l.*

60 P. Hanson: the *Reserve Number* and *Highly Commended.*

Class 13.—*Scotch Grey Cock and Three Hens.*

71 Duncan McLaren, Cornton Farm, Bridge of Allan, Stirlingshire: First Prize, 3*l.*

68 Rev. Arthur C. Davies, Aldborough Rectory, Hanworth, Norwich: Second Prize, 2*l.*

70 A. Watson Henderson, Maryfield, Bridge of Allan: Third Prize, 1*l.*

67 N. Stephen Black, Eye, Kettleby, Melton Mowbray: the *Reserve Number* and *Highly Commended.*

Class 14.—*Scotch Grey Cockerel and Three Pullets.*

74 Duncan McLaren: Second Prize, 2*l.*

Class 15.—*Andalusian Cock and Three Hens.*

77 Rev. Ernest R. O. Bridgeman, Blymhill Rectory, Shifnal: First Prize, 3*l.*

80 Edwin Merrall, Morton, Bingley, Yorkshire: Second Prize, 2*l.*

76 Henry Abbott, Rookery Farm, Thuxton, Hingham, Norfolk: Third Prize, 1*l.*

79 Mrs. M. Leighton, Bridge Street, Preston: the *Reserve Number* and *Highly Commended.*

Class 16.—*Andalusian Cockerel and Three Pullets.*

84 Edwin Merrall: First Prize, 3*l.*

81 Henry Abbott: Second Prize, 2*l.*

83 Messrs. Leighton and Halliwell, Bridge Street, Preston: Third Prize, 1*l.*

82 Rev. Ernest R. O. Bridgeman: the *Reserve Number.*

Class 17.—*Minorca Cock and Three Hens.*

91 William Snell, Jun., High Street, Crediton, Devon: First Prize, 3*l.*

89 Mrs. M. Leighton: Second Prize, 2*l.*

85 Henry Abbott: Third Prize, 1*l.*

88 John L'Estrange, Helsdon Road, Norwich: the *Reserve Number* and *Highly Commended.*

Class 18.—*Minorca Cockerel and Three Pullets.*

94 William T. Dominy, Milton Cottage, Chard, Somerset: First Prize, 3*l.*

93 Henry Abbott: Second Prize, 2*l.*

95 Messrs. Leighton and Halliwell: Third Prize, 1*l.*

Class 19.—*Black Hamburg Cock and Three Hens.*

97 Thomas C. Heath, Sneyd Cottage, Cobridge, Staffs: First Prize, 3*l.*

98 Edwin Merrall: Second Prize, 2*l.*

100 Henry R. Plattin, Fakenham, Norfolk: Third Prize, 1*l.*

101 Richard Rimmer, Church Town, Southport: the *Reserve Number* and *Highly Commended.*

Class 20.—*Black Hamburg Cockerel and Three Pullets.*

105 John Wilson, Micklethwaite, Bingley, Yorkshire: First Prize, 3*l.*

103 Edwin Merrall: Second Prize, 2*l.*

104 Henry Pickles, Rayfield House, Earby, Leeds: Third Prize, 1*l.*

Class 21.—*Hamburg Cock and Three Hens, any other variety.*

108 Robert Brown, Attwoods, Halstead, Essex: First Prize, 3*l.*

107 Rev. Seymour Ashwell, Finmere Rectory, Buckingham: Second Prize, 2*l.*

110 Henry Pickles: Third Prize, 1*l.*

109 Alfred Grantham, 530, Kingsland Road, Middlesex: the *Reserve Number.*

Class 22.—*Hamburg Cockerel and Three Pullets, any other variety.*

112 Henry Pickles: First Prize, 3*l.*

111 Brighten Hardy, Saham Hills, Watton, Norfolk: Second Prize, 2*l.*

Class 23.—*Leghorn Cock and Three Hens.*

115 Henry Cecil Brierley, 15, Sneinton Street, Nottingham: First Prize, 3*l.*

113 John Berry, Aire View, Silsden, Leeds: Second Prize, 2*l.*

117 John Hurst, South Terrace, Glossop: Derbyshire: Third Prize, 1*l.*

118 Joseph Pride, Thorverton, Cullompton, Devon: the *Reserve Number* and *Highly Commended.*

Class 24.—*Leghorn Cockerel and Three Pullets.*

122 Albert Curzon Bradbury, Nuthall, Nottingham: First Prize, 3*l.*

120 John Berry: Second Prize, 2*l.*

124 William Laugher, Point House, Exmouth: Third Prize, 1*l.*

121 Albert Curzon Bradbury: the *Reserve Number* and *Highly Commended.*

Class 25.—*Coloured Dorking Cock and Three Hens.*

128 Mrs. Wacher, Woodnesborough, Sandwich, Kent: First Prize, 3*l.*

127 Henry Humphrey, Ashington Mills, Pulborough, Sussex: Second Prize, 2*l.*

130 C. W. Waters, Herringby Hall, Stokesby, Great Yarmouth: Third Prize, 1*l.*

Class 26.—*Coloured Dorking Cockerel and Three Pullets.*

133 John N. Waite, Bramerton, Norwich: First Prize, 3*l.*

132 Benjamin B. Sapwell, Sankence, Aylsham, Norfolk: Second Prize, 2*l.*

131 Miss M. E. Hoult, St. Michael's Hall, Garstang, Lancashire: Third Prize, 1*l.*

Class 27.—*Silver Grey Dorking Cock and Three Hens.*

135 William Roe, Jun., North Scarle Field, Newark-on-Trent: First Prize, 3*l.*

136 William Ruttlidge, Storth End, Kendal, Westmoreland: Second Prize, 2*l.*

134 Richard Abbott, Thuxton Hingham, Norfolk: Third Prize, 1*l.*

Class 28.—*Silver Grey Dorking, Cockerel and Three Pullets.*

138 Arthur Major, Langley, Horsemoor Green, Buckinghamshire: First Prize, 3*l.*

137 Richard Abbott: Second Prize, 2*l.*

Class 29.—*Dorking Cock and Three Hens, any other variety.*

143 John E. Pilgrim, The Outwoods, Hinckley, Leicestershire: First Prize, 3*l.*

140 Alfred E. W. Darby, Little Ness, Shrewsbury: Second Prize, 2*l.*

144 John L. Playfoot, 85, High Street, Dorking: Third Prize, 1*l.*

141 Charles A. Gosnell, Feltham, Middlesex: the *Reserve Number* and *Highly Commended.*

CLASS 30.—*Dorking Cockerel and Three Pullets, any other variety.*

145 CHARLES A. GOSNELL: FIRST PRIZE, 3*l.*

146 PETER WILSON, Colvinston, Annobank, Ayrshire: SECOND PRIZE, 2*l.*

CLASS 31.—*Crèvecœur Cock and Three Hens.*

147 JOHN AINSWORTH, High Bank, Darwen, Lancashire: FIRST PRIZE, 3*l.*

148 JOHN T. CALVERT, 6, Park Street, Keighley, Yorkshire: SECOND PRIZE, 2*l.*

149 WILLIAM JACKSON, Bolton-le-Sands, Carnforth, Lancashire: THIRD PRIZE, 1*l.*

CLASS 32.—*Crèvecœur Cockerel and Three Pullets.*

151 JOHN T. CALVERT: SECOND PRIZE, 2*l.*

CLASS 33.—*Black or Brown Red Game Cock and Three Hens.*

155 ROBERT H. HOLDEN, Glenelg, Walsall, Staffs: FIRST PRIZE, 3*l.*

156 H. E. MARTIN, Burston Hall, Diss, Norfolk: SECOND PRIZE, 2*l.*

154 J. W. BROCKBANK, The Croft, Kirksanton, Carnforth: THIRD PRIZE, 1*l.*

157 SAMUEL MATTHEW, The Elms, Stowmarket, Suffolk: the *Reserve Number* and *Highly Commended.*

CLASS 34.—No Entry.

CLASS 35.—*Game Cock and Three Hens, any other variety.*

156 H. E. MARTIN: SECOND PRIZE, 2*l.*

159 CHARLES W. BRIERLEY, Rosedale, Tenbury, Worcestershire: THIRD PRIZE, 1*l.*: and (158) the *Reserve Number.*

CLASS 36.—No Entry.

DUCKS.

CLASS 37.—*Aylesbury Drake and Two Ducks.*

164 WILLIAM WESTON, 31, Mount Street, Aylesbury: FIRST PRIZE, 3*l.*

163 EBENEZER SNELL: SECOND PRIZE, 2*l.*

CLASS 38.—*Young Aylesbury Drake and Two Ducklings.*

165 ROBERT R. FOWLER, Prebendal Farms, Aylesbury: FIRST PRIZE, 3*l.*

167 WILLIAM WESTON: SECOND PRIZE, 2*l.*

166 THE DUKE OF HAMILTON, K.T., Easton Park, Wickham Market: THIRD PRIZE, 1*l.*

CLASS 39.—*Rouen Drake and Two Ducks.*

170 THOMAS WAKEFIELD, Golborne, Lancashire: FIRST PRIZE, 3*l.*

169 JOHN N. WAITE, Bramerton, Norwich: SECOND PRIZE, 2*l.*

168 EBENEZER SNELL: THIRD PRIZE, 1*l.*

171 C. W. WATERS, Herringby Hall, Stokesby, Great Yarmouth: the *Reserve Number.*

CLASS 40.—*Young Rouen Drake and Two Ducklings.*

177 THOMAS WAKEFIELD: FIRST PRIZE, 3*l.*

173 ROBERT R. FOWLER: SECOND PRIZE, 2*l.*

175 ALBERT D. SUTCLIFFE, 23, Great Ancoat Street, Manchester: THIRD PRIZE, 1*l.*

CLASS 41.—*Drake and Two Ducks, any other variety.*

181 EBENEZER SNELL: FIRST PRIZE, 3*l.*

180 JOHN FRANCIS ROGERS, Swanington, Norwich: SECOND PRIZE, 2*l.*

179 THE DUKE OF HAMILTON, K.T.: THIRD PRIZE, 1*l.*

CLASS 42.—*Young Drake and Two Ducklings, any other variety.*

182 ROBERT R. FOWLER: FIRST PRIZE, 3*l.*

GEESE.

CLASS 43.—*Gander and Two Geese.*

184 EBENEZER SNELL: FIRST PRIZE, 3*l.*

183 THE DUKE OF HAMILTON, K.T.: THIRD PRIZE, 1*l.*

CLASS 44.—No Entry.

TURKEYS.

CLASS 45.—*Black or Bronze, Cock and Two Hens.*

186 EDWARD KENDRICK, Jun., Weeford House, Lichfield, Staffs: FIRST PRIZE, 3*l.*

CLASS 46.—*Black or Bronze, Cockerel and Two Poults.*

191 MRS. J. SHENTON, The Home Farm, Hints, Tamworth: FIRST PRIZE, 3*l.*

190 EDWARD KENDRICK, Jun.: SECOND PRIZE, 2*l.*; and (189) THIRD PRIZE, 1*l.*

CLASSES 47 and 48.—No Entry.

IMPLEMENTS.

1917 BARNARD AND LAKE, Rayne Foundry, Braintree, Essex: the PRIZE, 25*l.*, for their Thatch-making Machine.

SILVER MEDALS.

762 W. RAINFORTH AND SONS, Britannia Works, Lincoln; for their Self-cleansing Corn Screen.

903 THE AYLESBURY DAIRY COMPANY, 31, St. Petersburgh Place, Bayswater, London; for Lever and Rachett motion in Johnson's Ensilage Stack Press.

1399 SMITH AND GRACE, Thrapston; for Smith's Patent Convertible Belt-Pulley with screwed Bush.

1096 THE DAIRY SUPPLY COMPANY, Museum Street, London; for The Délaiteuse, for extracting Butter-milk from Butter.

3848 RANSOMES, SIMS, AND JEFFERIES, Orwell Works, Ipswich; for their New Patent Self-acting Feeding Apparatus on Threshing Machine.

FARM PRIZES.*

CLASS 1.—*For the best managed Arable and Grass Farm, exceeding* 550 *acres.*

1 GARRETT TAYLOR, Hall Farm, Whitlingham, Norwich: FIRST PRIZE, 100*l.*

2 HORACE WOLTON, Newburn Hall, Woodbridge: SECOND PRIZE, 50*l.*

CLASS 2.—*For the best managed Arable and Grass Farm of* 250 *acres and not exceeding* 550 *acres.*

4 EDWIN T. LEARNER, Burgh, Aylsham: FIRST PRIZE, 75*l.*

5 WILLIAM S. PROCTOR, Bexwell, Downham Market: SECOND PRIZE, 25*l.*

6 SAMUEL R. SHERWOOD, Hazelwood, Friston, Saxmundham: SECOND PRIZE 25*l.*†

3 EDWIN S. DURRANT, Wimbotsham, Downham Market: *Commended.*

7 HENRY SMITH, Great Melton, Wymondham: *Commended.*

CLASS 3.—*For the best managed Arable and Grass Farm, above* 100 *acres and not exceeding* 250 *acres.*

11 SPENCER R. TURNER, Hunston Lodge, Bury St. Edmunds: FIRST PRIZE, 50*l.*

8 JOHN BALY AND SON, Hardingham, Hingham: SECOND PRIZE, 25*l.*

10 JOSEPH SMITH, Thorpe Hall, Hasketon, Woodbridge: *Commended,* for Walnut Tree Farm, Henley.

CLASS 4.—*For the best managed Arable and Grass Farm, not exceeding* 100 *acres in extent.*

12 CHARLES DEVEREUX, Starston, Harleston: FIRST PRIZE, 25*l.*

14 EDGAR SCRUTTON, Brandeston, Framlingham: SECOND PRIZE, 10*l.*

---

† Given by the Royal Agricultural Society on the recommendation of the Judges.

Prizes recommended by the Farm Judges for the Award of Certificates.

ROBERT FLOTMAN, for 15 years labourer on Mr. Learner's Farm at Burgh, and for 44 years previous employment on the same farm. Obtained in 1870 a Certificate for Merit and long servitude from the South Erpingham Agricultural Association. Is now in 83rd year, and earns 6*s.* per week at work.

WILLIAM PLUMMER, for 40 years labourer on the Hunston Lodge Farm, and recommended by his employer, Mr. S. Turner, as a capital workman and of good character.

WILLIAM STIFF, for 23 years labourer on Hunston Lodge Farm, recommended by employer as a most valuable servant, sticking to his employer during the strike among labourers a few years ago.

JAMES GROOM, labourer for 71 years on Bexwell Farm. Is now in 83rd year of his age, and yet able to earn a full wage. He had Certificates from the West Norfolk Agricultural Association in 1856, 1857, and 1858, for general good character, and for bringing up the largest family with the least assistance. Recommended by his employer, Mr. Wm. Proctor.

ISAAC FINCHAM, for 56 years labourer on Bexwell Farm, recommended by his employer as an excellent servant, bringing up a large and respectable family. Is in 76th year of age and able to earn 8*s.* per week.

PRACTICAL EXAMINATION OF BUTTERMAKERS.

Certificates of Efficiency have been awarded as follows :—

F. GINGER, St. Petersburgh Place, Bayswater : FIRST PRIZE, 5*l.*

F. BALLARD, The Winnings, Colwall, Great Malvern : SECOND PRIZE, 3*l.*

MISS HOLMES, Sundridge Park Farm, Bromley : THIRD PRIZE, 2*l.*

AGRICULTURAL EDUCATION.

Examination Papers, 1886.

EXAMINATION IN AGRICULTURE.

Maximum Number of Marks, 100. Pass Number, 50.

Tuesday, May 11th, from 10 a.m. till 1 p.m.

1. What capital would be required, say for a suburban farm of 300 acres, medium soil, near to a market, and where almost everything is grown to be sold off with a profitable return in view?

2. State what live-stock, and principal general implements are required, with the cost of the said stock, and implements, for working the farm described in question No. 1.

3. State the best rotation of crops for the same farm.

4. Write a short paper on the cultivation and general management with cost of all rotation crops included in the answer to Question 3, including storage, if the crops are not sent direct from field to market. Give also the quantity and value of artificial farmyard-manure per acre, including the quantity of seeds for each rotation crop per acre; state also the best time of year for putting in the same to obtain the best result.

5. State at what stage of growth you would cut rotation grasses or clover (1st year) for hay.

6. Describe the general management to make the same into the best possible hay.

7. What quantity, if any, would you reserve for silage?

8. State what difference, if any, there should be as to the treatment of 2nd and 3rd years' rotation grasses, being made into hay if not grazed.

9. What stock should 2nd or 3rd years' grass, if any, be grazed with, if it is not made into hay?

10. State what weekly quantity and kinds of food should be given to a team of two good farm horses, with a view to keep them in healthy working condition.

11. State at what time of year it would be desirable to change the food of working horses from dry to soft, or green food with or without corn—giving the quantity and mixture per team per week.

12. Write a short paper on the general management, cost of working, amount of capital, quantity of each kind of stock, of a 400-acre medium soil, mixed farm, where half the produce is sold off, and the

other half consumed—a milking stock of 20 to 60 cows kept, the milk being taken to a railway station, say three miles off.

13. Write a brief paper on the general management of a 500-acre stock farm, horses, cattle and sheep breeding, where the produce is mostly consumed.

14. Classify the best known breeds of cattle for milking purposes.

15. Classify the best for beef and fattening purposes.

16. Classify the best breeds of sheep for wool and mutton.

EXAMINATION IN CHEMISTRY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

I. AGRICULTURAL CHEMISTRY.

Wednesday, May 12th, from 2 p.m. till 5 p.m.

1. Describe the changes of chemical composition that take place during the development of a mangold from the seed to the fully grown plant. What further changes take place in the plant (*a*) during storing, (*b*) if allowed to remain in the ground?

2. What are the chemical advantages of a rotation of crops? Illustrate by an example.

3. Name any injurious ingredients met with in soils; state the soils where and circumstances under which these are generally found, and suggest means for their correction.

4. A farmer wishes to supply potash (K_2O) to a field at the rate of 50 lbs. to the acre. Mention different forms in which he might supply this, and what quantity of each manure, as commercially supplied, would give the requisite amount.

5. Assuming the manure from 1000 lbs. decorticated cotton-cake to contain:—phosphoric acid (P_2O_5) 33 lbs.; potash (K_2O) 31 lbs.; ammonia (NH_3) 70 lbs.; how could these quantities be supplied in the following artificial manures:—Bone-ash super-phosphate, containing 40 per cent. soluble phosphate; sulphate of potash (95 per cent. pure); and nitrate of soda (95 per cent. pure)?

6. In what forms are bones used in agriculture? Name the different forms and percentage quantities in which the principal manurial ingredients occur.

7. In what forms does nitrogen exist in foods? What is meant by the term "albuminoid ratio," and how is it reckoned? Give approximately the albuminoid ratio in the following foods:—Linseed-cake; decorticated cotton-cake; maize; beans; mangolds; meadow-hay; wheat-straw.

8. Mention any circumstances which may act prejudicially and render care necessary in the use as food, and also economical purchase of the following:—Decorticated cotton-cake; undecorticated cotton-cake; linseed-cake; rape-cake.

II. General Chemistry.

Wednesday, May 12th, from 10 a.m. till 1 p.m.

1. Describe the oxides of carbon, their composition and most characteristic properties. What volume of carbonic acid gas can be produced from 120 grams of carbon?
   (1 gram of H fills 11·12 litres, and $C = 12$.)

2. Explain how chlorine is prepared, and chloride of lime. Also how the latter substance may be made to yield chlorine. Chlorine is called an oxidizing agent: explain why.

3. State the composition of ammonia: and explain how a nitrate may be made to yield ammonia. In what respects do ammonia and its salts resemble potash and its salts?

4. What are *basic* oxides? Give examples of such oxides, and show how their basic character exhibits itself. Give also examples of neutral oxides, and acid oxides. In which classes do you place the several oxides of iron, lead, and tin?

5. Give an account of the compounds which sulphur forms with each of the elements hydrogen, oxygen, and carbon, respectively. What weight of sulphuric acid can be made from 112 lbs. of sulphur; and how much chalk will be required to neutralize that weight of the acid?
   ($O : S : C : Ca : = 16 : 32 : 12 : 40$.)

6. What is the difference between a ferrous and a ferric salt? Sulphurous acid will reduce a ferric salt to a ferrous, and bromine will reverse that change: explain the chemistry of the reactions.

7. By what characters can you detect lead acetate, mercuric chloride, and arsenious acid respectively? How can you distinguish an arseniate from a phosphate?

8. Explain the chemical change which goes on in the alcoholic fermentation. Show how to determine the strength of a solution of alcohol.

9. What elements enter into the composition of albumen? Mention different forms of that substance. How can it be distinguished from gelatine? How is albumen affected by mercuric chloride, and by carbolic acid?

MENSURATION AND LAND SURVEYING.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Thursday, May 13th, from 2 p.m. till 5 p.m.

1. State the rule for finding the area of a quadrilateral, two of whose sides are parallel.

If the parallel sides are 50 feet apart, and one of them 100 feet long, what is the length of the other parallel side if the area of the quadrilateral is 7000 square feet?

2. The base of a cylindrical tank has a diameter of 12 feet; what is its depth if it is capable of holding 1000 cubic feet of water?

3. A hole, with a uniform depth of 10 feet, is dug in level ground; its bottom is a rectangle 100 feet by 30 feet; the slopes of the side are 1 vertical to 2 horizontal; draw a plan of the hole, and calculate the number of cubic feet of earth removed in digging it.

4. A B C is a triangular piece of ground; the sides A B and B C can be measured, but A C passes through a pond; explain how you could get the data for drawing the triangle A B C, and so for determining the length of A C, if you have nothing but a measuring tape and pegs.

5. A line A B passes through a narrow piece of ground; from the annexed measurements draw a plan of the ground, and find its area.

	B	
210	1500	20
	600	160
	410	90
110	320	210
180	000	
From	A go	East

6. Two points on a map are 10 inches apart; the points on the ground are a quarter of a mile apart; draw a scale for the map on which distances from 10 feet up to 500 feet can be measured.

If the lengths of the sides of a triangle on the map are 13·52 in., 14·16 in. and 12·96 in.; what is the area of the triangle on the ground in acres?

7. Calculate the altitude of the sun when a pole 40 feet high casts on horizontal ground a shadow 73 feet long.

8. Write down a formula, adapted to logarithms, by which to calculate an angle of a triangle whose three sides are known. Apply it to calculate the smallest angle of the triangle whose sides are 751, 892, 1007 feet respectively.

EXAMINATION IN MECHANICS AND NATURAL PHILOSOPHY.

MAXIMUM NUMBER OF MARKS, 200. PASS NUMBER, 100.

Thursday, May 13th, from 10 a.m. till 1 p.m.

1. Where is the centre of gravity of a circular plate, of a square plate, and of a triangular plate; each plate being very thin and of uniform density?

If the square plate is bent along a diagonal so that the two parts are at right angles to each other, where is its centre of gravity now situated?

2. Define the co-efficient of friction and the angle of friction.

A body weighing 100 lbs. is placed on a horizontal table; a thread fastened to it passes horizontally over a small pulley at the edge of the table; it is found that the body will just not slide, when a weight of 17·5 lbs. is hung to the end of the thread. What is the co-efficient of friction between the body and the table? If the string were cut and the table tilted up, find (by construction or calculation) the number of degrees in its angle of inclination to the horizon when the body is just on the point of sliding down.

3. A B is a uniform rod of given weight (100 lbs.) capable of turning round a hinge A; the end B is fastened by a thread to a point C vertically over A; the lengths of the rod and thread are such that B C is horizontal, and A B at an angle of 60° to the horizon; find (by construction or calculation) the tension of the thread, and the magnitude and direction of the pressure on the hinge.

4. State (without proof) the relation between the power and the weight in a common screw press working without friction.

The pitch of the screw is 1 in. and the length of the power arm 21 in., what power would be required to lift a ton weight, if the machine worked without friction? If it were found that in point of fact a power of 100 lbs. was required, what part of the power would be expended on friction ($7\pi = 22$)?

5. When a body of considerable size is moved, how is the work done against gravity calculated?

A rectangular block, whose base is 4 feet square and length 20 feet, lies horizontally on one side; how many foot-pounds of work are done against gravity when it is placed upright on its base, one cubic foot of the material weighing 150 lbs.?

6. State (without proof) a formula for determining the distance described in a given time by a body whose velocity undergoes a constant acceleration.

If a body's velocity undergoes a constant acceleration, what inference can you draw as to the force which produces the motion?

A body, moving from a state of rest, has its velocity increased in every second by 3 feet a second, in what time will it describe a distance of a mile? and with what velocity will it be moving at the end of the mile?

7. A cask stands upright; a pipe passes through the bung-hole, the junction being made watertight; the cask is then filled with water, and the water rises in the pipe to a vertical height of 9 feet above the bung-hole; if the top of the cask is 1·5 feet above, and the bottom of the cask 1·5 feet below the bung-hole, what is the pressure per square inch on the top and on the bottom of the cask, assuming that 4 cubic inches of water weigh 7 oz.?

Explain why the result is independent of the size and shape of the pipe?

8. Given that a glycerine barometer reads 325·9 in. when the mercurial barometer reads 30·3 in., find the specific gravity of glycerine, having given that, that of mercury is 13·569. Would the result be true at all temperatures?

9. Describe briefly the eccentric and its use in the steam engine, showing that it is a kind of crank.

The diameter of the main axis being one foot, draw a sketch of an eccentric which shall make the slide valve move backward and forward through a distance of 9 in.

EXAMINATION IN BOOK-KEEPING.

Maximum Number of Marks, 200. Pass Number, 100.

Friday, May 14th, from 10 a.m. till 1 p.m.

Journalize and post in proper technical language and form the following imaginary transactions; and draw out therefrom a "Trial Balance," "Profit and Loss Account," and "Balance-sheet."

On the 1st January, 1886, the Balance-sheet of John Holmes represented:—

Liabilities.	£	s.	d.
Overdrawn Bank Account	1560	13	0
(against which the Bank hold security, viz. Deeds of Freehold Property, valued at 2000*l.*)			
Rent due to J. Symes	100	0	0
Promissory Notes—			
J. Walker, due 14th January, 1886	20	0	0
H. Parker, due 7th February, 1886	15	0	0
Amount due to G. Dyson	173	0	0
	£1868	13	0

Assets.		£	s.	d.
Hay and Straw		450	0	0
Root Crops		275	0	0
Horses, Carts, Ploughs, &c.		220	0	0
Value of Live Stock		1393	0	0
Debt due from G. Causton		230	0	0
Petty Cash		26	0	0
Bills Receivable—				
Due 4th January, 1886	234 0 0			
Due 4th February, 1886	150 0 0			
		384	0	0
Freehold Property (in hands of Bankers) valued at ..		2000	0	0
		£4978	0	0

And his business transactions during the month of January, were as follows, viz.:—

Note.—All Cash transactions, other than Petty Cash, are to be treated as passing through Bank Account.

		£	s.	d.
Jan.	1.—Drew from Bankers on account of Petty Cash	20	0	0
„	2.—Received from G. Causton on account of Debt	150	0	0
„	3.—Paid to T. Rowlands for Oilcake bought ..	105	0	0
„	3.—Received from J. King for a Cart-horse ..	45	0	0
„	4.—Bills Receivable due this day duly met and proceeds paid into Bank	234	0	0
„	5.—Paid Rent due to J. Symes	100	0	0
„	7.—Received for sale of Heifers	375	0	0
„	8.—Bought from J. Tubbs Live-Stock, and accepted his Draft, due 8th March	1002	0	0
„	10.—Paid for a Cart-horse	35	0	0
„	14.—Received from F. Adams for Mangold ..	74	9	3
„	14.—Paid Promissory Note due this day	20	0	0
„	21.—Sold to C. Eley Live-Stock, for which he gave his Acceptance, due 22nd April ..	750	0	0
„	21.—Discounted C. Eley's Bill—Banker's charging 3*l.* 15*s.* for discount			
„	29.—Paid for Management and Labour	55	0	0
„	31.—Paid out of Petty Cash for sundry Petty Expenses	30	0	0
„	31.—Amount accrued due to Banker's for interest	6	15	2
„	31.—Stock remaining on hand at end of the month—			
	Hay and Straw	300	0	0
	Root Crops	148	3	3
	Oilcake	70	11	5
	Live-Stock	1450	0	0
	Horses, &c.	220	0	0

EXAMINATION IN GEOLOGY.

MAXIMUM NUMBER OF MARKS, 100. PASS NUMBER, 50.

Friday, May 14th, from 2 p.m. till 5 p.m.

1. What is a Fossil? Why are Fossils of use to a Geologist? What conclusions would he arrive at if he found either Ammonites, Goniatites, Graptolites, Nummulites, or Turrilites, as the predominating fossils at places under his examination?

2. Draw and describe a general geological section across England and Wales; and explain why the strata form higher ground on the West than on the East.

3. Explain the processes in the *disintegration* of *limestone* and *granite*, respectively, by atmospheric agency; and give the results in each case.

4. Draw the section of a hill, one slope of which cuts the outcrops of alternate horizontal beds of clay and sand at a low angle; and explain how the natural drainage would affect—(1) the fields occupying that hill-side; (2) a road passing up the hill; (3) a deep cutting along that road, made for laying large pipes to a town at the foot of the hill.

5. If you met with a stratum containing *Anthracosia*, *Pecopteris*, *Megalichthys*, and *Bellinurus*, to what geological formation would you refer it? What Fossils would you expect to find in the strata above and below it, respectively?

6. Give a brief account of the general geology, of either Scotland or Ireland, pointing out where any materials of economic value are found, and why some of the districts are agriculturally good or otherwise.

7. Mention some of the best districts for Sheep-walks, Grass-lands, and Corn-fields in England, and give the geological reasons for their existence.

8. If you met with a thick dark-coloured Clay-formation anywhere in the South of England, what Fossils would you expect to meet with in it to enable you to decide whether it was the Gault, or the Kimmeridge, or Oxford Clay?

9. What are the chief Mineral Manures? Of what are they composed? How are they prepared? Whence and from what Formations are the natural materials obtained?

10. Describe some different kinds of Soil, mentioning their localities; and explain their origin and peculiarities.

11. Enumerate the different stony materials usually used for making and mending Roads. Where are they got? Give your reasons for regarding some as better than others.

12. Name and describe the Specimens on the Table.

EXAMINATION IN BOTANY.

[It is expected that Eight Questions at least will be answered.]

Maximum Number of Marks, 100. Pass Number, 50.

Saturday, May 15th, from 10 a.m. till 1 p.m.

1. Describe the structure and contents of a living cell.

2. What are the different elements of the food of plants, where are they obtained, and how are they assimilated?

3. What are — 1. An angiosperm and a gymnosperm? 2. A monocotyledon, a dicotyledon and a polycotyledon? 3. An albuminous and an ex-albuminous seed? And give examples of each from British plants.

4. Of what service is water to the plant?

5. Name three plants belonging to different Natural Orders that utilise animal matter, and explain the modification of organs in each plant for this purpose.

6. What parasites attack Red Clover? Give their scientific and common names and explain the different methods of their attack.

7. State shortly the life-history of the fungus which causes the red rust in wheat.

8. What methods would you propose for obtaining new varieties or races of plants, and explain the reasons for your proposals.

9. How does the plant benefit from artificial manures?

10. What plants of the Order Umbelliferæ are cultivated in Britain?

11. Give the scientific names and Natural Orders of the following plants:—Broom, Meadow Foxtail, Butcher's Broom, Horsetail, Lucerne and Timothy.

12. Describe the plants, A B and C, taking the organs, if present, in the following order:—root, stem, leaves, bracts, sepals, petals, stamens, pistil, fruit and seeds.

EXAMINATION IN ANATOMY AND ANIMAL PHYSIOLOGY.

Maximum Number of Marks, 100. Pass Number, 50.

Saturday, May 15th, from 2 p.m. till 4 p.m.

1. Describe fully the anatomy of the heart, and state the cause, or causes, which produce its pulsatory action. Name also the vessels which are directly connected with the organs as conveyers of blood either to or from it.

2. State the chief differences which exist between arterial and venous blood, and name the principal vessels, whether arteries or veins, through which *venous* blood passes in the general circulation.

3. Describe the processes of mastication, insalivation, and rumination, and name the effect which each produces on the food, and in what way digestion and assimilation are promoted thereby.

4. Name the chief fluids which are employed in the digestive and assimilative processes, and the provision which is made for the conveyance of nutritive matter into the blood.

5. Name the several bones which form the skull and face of the Ox, particularising those which constitute the cavity in which the brain is placed, and those in which the teeth are implanted.

6. Describe the bones and other structures which are combined to form the foot of the Ox, and name the provisions which exists for the development and growth of the horn or hoof, and the means by which one digit is united to the other.

7. Suppose a needle be passed through the central part of the eye from front to back, what membranes would it penetrate, and with what bone would its point come in contact?

MEMORANDA.

ADDRESS OF LETTERS.—The Society's office being situated in the postal district designated by the letter W. Members, in their correspondence with the Secretary, are requested to subjoin that letter to the usual address.

GENERAL MEETING in London, December, 1886.

GENERAL MEETING in London, May 23rd, 1887, at 12 o'clock.

MEETING at Newcastle-on-Tyne, July, 1887.

MONTHLY COUNCIL (for transaction of business), at 12 o'clock on the first Wednesday in every month, excepting January, September, and October: open only to Members of Council and Governors of the Society.

ADJOURNMENTS.—The Council adjourn over Passion and Easter weeks, when those weeks do not include the first Wednesday of the month; from the first Wednesday in August to the first Wednesday in November; and from the first Wednesday in December to the first Wednesday in February.

OFFICE HOURS.—10 to 4. On Saturdays, 10 to 2.

DISEASES of Cattle, Sheep, and Pigs.—Members have the privilege of applying to the Veterinary Committee of the Society, and of sending animals to the Royal Veterinary College, Camden Town, N.W.—(A statement of these privileges will be found on page cxxiii in this Appendix.)

CHEMICAL ANALYSIS.—The privileges of Chemical Analysis enjoyed by Members of the Society will be found stated in this Appendix (page cxx).

BOTANICAL AND ENTOMOLOGICAL PRIVILEGES.—The Botanical and Entomological Privileges enjoyed by Members of the Society will be found stated in this Appendix (page cxxv).

SUBSCRIPTIONS.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for 20 years or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member.

PAYMENTS.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the Office of the Society, No. 12, Hanover Square, London, W., or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a banker's or any other house of business in London will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the postmaster the correct initials and surname of the Secretary of the Society (H. M. Jenkins), otherwise the payment will be refused to him at the post-office on which such order has been obtained; and when remitting the money-orders it should be stated by whom, and on whose account, they are sent. Cheques should be made payable as drafts on demand (not as bills only payable after sight or a certain number of days after date), and should be drawn on a London (not on a local country) banker. When payment is made to the London and Westminster Bank, St. James's Square Branch, as the bankers of the Society, it will be desirable that the Secretary should be advised by letter of such payment, in order that the entry in the banker's book may be at once identified, and the amount posted to the credit of the proper party. No coin can be remitted by post unless the letter be registered.

NEW MEMBERS.—Every candidate for admission into the Society must be proposed by a Member; the proposer to specify in writing the full name, usual place of residence, and post-town, of the candidate, either at a Council meeting, or by letter addressed to the Secretary. Forms of Proposal may be obtained on application to the Secretary.

***** Members may obtain on application to the Secretary copies of an Abstract of the Charter and Bye-laws, of a Statement of the General Objects, &c., of the Society, of Chemical, Botanical and Veterinary Privileges, and of other printed papers connected with special departments of the Society's business.**

Governors' and Members' Privileges of Chemical Analysis.

(Applicable only to the case of Persons who are not commercially engaged in the manufacture or sale of any substance sent for Analysis.)

THE Council have fixed the following rates of Charges for Analysis to be made by the Consulting Chemist for the *boná fide* and sole use of Members of the Society. Members have also the privilege of sending samples for Analysis on behalf of any Farming Company of which they may be directors or managers, provided that the substances so sent shall be for use on the farm of the Company and not for sale to other persons. Members of the Society are also allowed to send to the Society's Laboratory for analysis, at the same scale of fees, any manures and feeding stuffs which are to be used by their outgoing tenants, or which they propose to give free of cost to their occupying tenants. To avoid all unnecessary correspondence, Members are particularly requested, when applying to the Consulting Chemist, to mention the kind of analysis they require, and to quote its number in the subjoined schedule.

The charge for analysis, together with the cost of the carriage of the specimens (if any), must be paid to the Consulting Chemist at the time of application.

No.		
1.	An opinion of the genuineness of bone-dust or oil-cake (each sample)	2*s.* 6*d.*
2.	An estimate of the value (relatively to the average samples in the market) of sulphate and muriate of ammonia and of the nitrates of potash and soda	5*s.*
3.	An analysis of guano; showing the proportion of moisture, organic matter, sand, phosphate of lime, alkaline salts and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
4.	An analysis of mineral superphosphate of lime for soluble phosphates only, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	5*s.*
5.	An analysis of superphosphate of lime, showing the proportions of moisture, organic matter, sand, soluble and insoluble phosphates, sulphate of lime, and ammonia, and an estimate of its value, provided the selling price of the article to be analysed be sent with it	10*s.*
6.	An analysis, showing the value of bone-dust or any other ordinary artificial manure, provided the selling price of the manure to be analysed be sent with it	10*s.*
7.	An analysis of limestone, showing the proportion of lime	7*s.* 6*d.*
8.	An analysis of limestone, showing the proportion of lime and magnesia	10*s.*
9.	An analysis of limestone or marls, showing the proportion of carbonate, phosphate, and sulphate of lime and magnesia, with sand and clay	10*s.*
10.	Partial analysis of a soil, including determinations of clay, sand, organic matter, and carbonate of lime	10*s.*
11.	Complete analysis of a soil	£3
12.	An analysis of oil-cake or other substance used for feeding purposes, showing the proportion of moisture, oil, mineral matter, albuminous matter, and woody fibre, as well as of starch, gum, and sugar in the aggregate; and an opinion of its feeding and fattening or milk-producing properties	10*s.*
13.	Analysis of any vegetable product	10*s.*
14.	Analysis of animal products, refuse substances used for manures, &c.	from 10*s.* to £1
15.	Determination of the "hardness" of a sample of water before and after boiling	5*s.*
16.	Analysis of water of land-drainage, and of water used for irrigation	£1
17.	Analysis of water used for domestic purposes	£1 10*s.*
18.	Determination of nitric acid in a sample of water	10*s.*
19.	Examination of Viscera for Metallic poison	£2 2*s.*
20.	Examination of Viscera complete, for metals and alkaloids	£5 5*s.*
21.	Personal consultation with the Consulting Chemist. (The usual hours of attendance, Monday excepted, will be from 11 to 3, but to prevent disappointment, it is suggested that Members desiring to hold a consultation with the Consulting Chemist should write to make an appointment)	5*s.*
22.	Consultation by letter	5*s.*
23.	Consultation necessitating the writing of three or more letters	10*s.*

The Laboratory of the Society is at 12, Hanover Square, London, W., to which address the Consulting Chemist, Dr. J. AUGUSTUS VOELCKER, requests that all letters and parcels (postage and carriage paid) from Members of the Society, who are entitled to avail themselves of the foregoing Privileges, should be directed.

GUIDE TO THE PURCHASE OF ARTIFICIAL MANURES AND FEEDING STUFFS.

FEEDING CAKES.

1. *Linseed-cake* should be purchased as "Pure," and the insertion of this word on the invoice should be insisted upon. The use of such words as "Best," "Genuine," &c., should be objected to by the purchaser.
2. *Rape-cake for feeding purposes* should be guaranteed "Pure," and purchased by sample.
3. *Decorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.
4. *Undecorticated Cotton-cake* should be guaranteed "Pure," and purchased by sample.

N.B.—All feeding cakes should be purchased in good condition, and the guarantee of the vendor should be immediately checked by a fair sample (taken out of the middle of the cake) being at once sent for examination to a competent analytical chemist. The remainder of the cake from which the sample sent for examination had been taken should be sealed up in the presence of a witness, and retained by the purchaser for reference in case of dispute.

ARTIFICIAL MANURES.

1. *Raw or Green Bones or Bone-dust* should be purchased as "Pure" Raw Bones guaranteed to contain not less than 45 per cent. of tribasic phosphate of lime, and to yield not less than 4 per cent. of ammonia.
2. *Boiled Bones* should be purchased as "Pure" Boiled Bones guaranteed to contain not less than 48 per cent. of tribasic phosphate of lime, and to yield not less than 1¾ per cent. of ammonia.
3. *Dissolved Bones* are made of various qualities, and are sold at various prices per ton; therefore the quality should be guaranteed, under the heads of *soluble* phosphate of lime, *insoluble* phosphate of lime, and nitrogen or its equivalent as ammonia. The purchaser should also stipulate for an allowance for each unit per cent. which the dissolved bones should be found on analysis to contain less than the guaranteed percentages of the three substances already mentioned.
4. *Mineral Superphosphates* should be guaranteed to be delivered in a sufficiently dry and powdery condition, and to contain a certain percentage of *soluble* phosphate of lime, at a certain price per unit per cent., no value to be attached to *insoluble* phosphates.
5. *Compound Artificial Manures* should be purchased in the same manner and with the same guarantees as Dissolved Bones.
6. *Nitrate of Soda* should be guaranteed by the vendor to contain from 94 to 95 per cent. of pure nitrate.
7. *Sulphate of Ammonia* should be guaranteed by the vendor to contain not less than 23 per cent. of ammonia.
8. *Peruvian Guano* should be sold under that name, and guaranteed to be in a dry and friable condition, and to contain a certain percentage of ammonia.

N.B.—Artificial manures should be guaranteed to be delivered in a sufficiently dry and powdery condition to admit of distribution by the drill. A sample for analysis should be taken, not later than three days after delivery, by emptying several bags, mixing the contents together, and filling two tins holding about half a pound each, in the presence of a witness. Both the tins should be sealed, one kept by the purchaser for reference in case of dispute, and the other forwarded to a competent analytical chemist for examination.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES FOR ANALYSIS.

ARTIFICIAL MANURES.—Take a large handful of the manure from three or four bags, mix the whole on a large sheet of paper, breaking down with the hand any lumps present, and fold up in tinfoil, or in oil-silk, about 3 oz. of the well-mixed sample, and send it to 12, HANOVER SQUARE, W., by post; or place the mixed manure in a small wooden or tin box, which may be tied by string, but must not be sealed, and send it by post. If the manure be very wet and lumpy, a larger boxful, weighing from 10 to 12 oz., should be sent either by post or railway.

Samples not exceeding 4 oz. in weight may be sent by post, by attaching two penny postage stamps to the parcel.

Samples not exceeding 8 oz., for three postage stamps.

Samples not exceeding 12 oz., for four postage stamps.

The parcels should be addressed: DR. J. AUGUSTUS VOELCKER, 12, HANOVER SQUARE, LONDON, W., and the address of the sender or the number of mark of the article be stated on parcels.

The samples may be sent in covers, or in boxes, bags of linen or other materials. No parcel sent by post must exceed 12 oz. in weight, 1 foot 6 inches in length, 9 inches in width, and 6 inches in depth.

SOILS.—Have a wooden box made 6 inches long and wide, and from 9 to 12 inches deep, according to the depth of soil and subsoil of the field. Mark out in the field a space of about 12 inches square; dig round in a slanting direction a trench, so as to leave undisturbed a block of soil with its subsoil 9 to 12 inches deep; trim this block or plan of the field to make it fit into the wooden box, invert the open box over it, press down firmly, then pass a spade under the box and lift it up, gently turn over the box, nail on the lid, and send it by goods or parcel train to the laboratory. The soil will then be received in the exact position in which it is found in the field.

In the case of very light, sandy, and porous soils, the wooden box may be at once inverted over the soil and forced down by pressure, and then dug out.

WATERS.—The water, if possible, should be sent in a glass-stoppered Winchester half-gallon bottle, which is readily obtained in any chemist and druggist's shop. If Winchester bottles cannot be procured, the water may be sent in perfectly clean new stoneware spirit-jars, surrounded by wickerwork. For the determination of the degree of hardness before and after boiling, only one quart wine-bottle full of water is required.

LIMESTONES, MARLS, IRONSTONES, AND OTHER MINERALS.—Whole pieces, weighing from 3 to 4 oz., should be sent enclosed in small linen bags, or wrapped in paper. Postage 2*d*., if under 4 oz.

OILCAKES.—Take a sample from the middle of the cake. To this end break a whole cake into two. Then break off a piece from the end where the two halves were joined together, and wrap it in paper, and send by parcels post. The piece should weigh at least from 10 to 12 oz. If sent by railway, one quarter or half a cake should be forwarded, carriage prepaid..

FEEDING MEALS.—About 3 oz. will be sufficient for analysis. Enclose the meal in a small linen bag. Send it by post.

On forwarding samples, separate letters should be sent to the laboratory, specifying the nature of the information required, and, if possible, the object in view.

Members' Veterinary Privileges.

I.—Visits of a Professor of the Royal Veterinary College.

1. Any Member of the Society who may desire professional attendance and special advice in cases of disease among his cattle, sheep, or pigs, should apply to the Secretary of the Society, or to the Principal of the Royal Veterinary College, Camden Town, London, N.W.

2. The remuneration of the Veterinary Surgeon or a visiting Inspector will be 2*l.* 2*s.* each day as a professional fee, and the charge for personal expenses, *when such have been incurred*, which will in no case exceed one guinea per diem. He will also be allowed to charge the cost of travelling, including railway fare, and one shilling per mile if by road, to and from the locality where his services may have been required. The whole or any portion of these charges may, however, in cases of serious or extensive outbreaks of contagious disease, be remitted, so far as the Members of the Society are concerned, at the discretion of the Council, on such step being recommended to them by the Veterinary Committee.

3. The Consulting Veterinary Surgeon or visiting Inspector, on his return, will report to the Member, and, through the Principal of the Royal Veterinary College, to the Veterinary Committee, in writing, the results of his observations and proceedings with reference to the disease; which Report will be laid before the Council.

4. When contingencies arise to prevent a personal discharge of the duties, the Principal of the Royal Veterinary College may, subject to the approval of the Veterinary Committee, name some competent professional person to act in his stead, who shall be remunerated at the same rate.

II.—Consultations without Visit.

Personal consultation with Veterinary Inspector	10*s.* 6*d.*
Consultation by letter	10*s.* 6*d.*
Post-mortem examination, and report thereon	21*s.*

A return of the number of applications from Members of the Society during each half-year is required from the Consulting Veterinary Surgeon.

III.—Admission of Diseased Animals to the Royal Veterinary College, Camden Town, N.W.; Investigations and Reports.

1. All Members of the Society have the privilege of sending cattle, sheep, and pigs to the Infirmary of the Royal Veterinary College, on the following terms, viz. by paying for the keep and treatment of cattle 10*s.* 6*d.* per week each animal, and for sheep and pigs, 3*s.* 6*d.* per week.

2. A detailed Report of the cases of cattle, sheep, and pigs treated in the Infirmary of the College, or on Farms in the occupation of Members of the Society, will be furnished to the Council quarterly; and also special reports from time to time on any matter of unusual interest which may come under the notice of the Officers of the College.

IV.—Visits of Provincial Veterinary Surgeons.

The following Veterinary Surgeons have been appointed, at different centres in England and Wales, for the purpose of enabling Members of the Society to consult them with regard to the diseases of cattle, sheep, and pigs.

County.	*Name and Address.*
Anglesey	Hugh Jones, Brynarron, Langefni.
Bedford	Henry Crofts, Harper Street, Bedford.
Berks	Henry Allnutt, Thames Street, Windsor.
Brecon	John Price, Brecon.
Bucks	G. A. Lepper, Aylesbury.
Cambridge	G. A. Banham, Downing Street, Cambridge.
Cardigan	Not yet appointed.
Carmarthen	ditto.
Carnarvon	R. Roberts, Market Street, Abergele.
Chester..	W. Lewis, 1, South Street, Nantwich Road, Crewe.
Cornwall	Thos. Olver, Truro.
Cumberland	John Bell, Lonsdale Street, Carlisle.
Denbigh	R. Roberts, Market Street, Abergele.

County.	*Name and Address.*
Derby	Not yet appointed.
Devon	W. Penhale, Barnstaple.
Dorset	W. Vessey, Weymouth.
Durham	H. Peele, Tower Street, West Hartlepool.
Essex	James Taylor, Vengewell Hall, Wix Manningtree.
Flint	R. Roberts, Market Street, Abergele.
Glamorgan	Charles Moir, Cardiff.
Gloucester	Prof. N. Almond, Royal Agricultural College, Cirencester.
Hants	J. D. Barford, 57, Above Bar, Southampton.
Hereford	W. Good, 30, Mill Street, Ludlow.
Herts	W. Wilson, Berkhampstead.
Hunts	A. T. Sprague, Kimbolton.
Kent	W. A. Edgar, Westfield House, Dartford.
Lancaster	W. Bromley, Lancaster.
Leicester	John Wiggins, Market Harbro'.
Lincoln (South)	Captain B. H. Russell, Grantham.
Lincoln (Mid)	Charles Hartley, 4, Norman Place, Lincoln.
Lincoln (North)	J. B. Greswell, Mercer Row, Louth.
Merioneth	Evan Wynne Williams, 1, Queen's Row, Dolgelly.
Metropolis and Middlesex	Royal Veterinary College.
Monmouth	G. Lewis, Monmouth.
Montgomery	James M'Cavin, Montgomery.
Norfolk	Calver and Smith, Downham Market.
Northampton	T. J. Merrick, Castilian Street, Northampton.
Northumberland and Westmoreland	C. Stephenson, Sandyford Villa, Newcastle-on-Tyne.
Notts	C. Gresswell, Albert Square, Derby Road, Nottingham.
Oxford	Chas. N. Page, Banbury.
Pembroke	D. E. James, Bridge House, Haverfordwest.
Salop	W. E. Litt, Shrewsbury.
Somerset	T. D. Broad, Broad Street, Bath.
Stafford	Harry Olver, Trescoe, Tamworth.
Suffolk	J. Worsley, Ipswich.
Surrey	J. I. Lupton, Richmond.
Sussex (East)	R. A. Stock, Lewes.
Sussex (West)	J. H. Callow, Horsham.
Warwick	Osborn Hills, Leamington.
Wilts	H. Hussey, Devizes.
Worcester	H. R. Perrins, Upper Butts, Worcester.
York (East Riding)	James Jebson, Yapham Grange, Pocklington.
York (North Riding)	W. Barker, Middlesborough.
York (West Riding)	Joseph Carter, 28, Great Horton Road, Bradford.

Members may obtain the attendance of a Provincial Veterinary Surgeon in any case of disease by paying his travelling expenses (which include railway fares, and 1*s.* per mile if by road, including the return journey), and the cost of his visit, which will be at the following rate, viz.:—

	£	*s.*	*d.*
When the whole day is occupied	1	10	0
When half a day or less is occupied	0	15	0
Personal consultation with Veterinary Surgeon	0	10	0
Consultation by letter	0	5	0
Post-mortem examination and report thereon	1	0	0

A return of the number of applications from Members of the Society during each half-year, embodying a statement of those cases which may be of public interest, is required from each Provincial Veterinary Surgeon. These half-yearly reports should reach the Secretary by the end of May and November respectively.

Members' Botanical and Entomological Privileges.

The Council have fixed the following rates of charge for the examination of Plants, Seeds, and Insects for the *bonâ fide* and individual use and information of Members of the Society (not being seedsmen), who are particularly requested, when applying to the Consulting Botanist, or to the Consulting Entomologist, to mention the kind of examination they require, and to quote its number in the subjoined schedule. The charge for examination must be paid at the time of application, and the carriage of all parcels must be prepaid.

I. BOTANICAL.

No.

1.—A report on the purity, amount, and nature of foreign materials, the perfectness, and germinating power of a sample of seed .. 5*s.*

2.—Determination of the species of any weed or other plant, or of any epiphyte or vegetable parasite, with a report on its habits, and the means for its extermination or prevention .. .. .. 5*s.*

3.—Report on any disease affecting farm crops .. .. 5*s.*

4.—Determination of the species of a collection of natural grasses found in any district, with a report on their habits and pasture value 10*s.*

N.B.—The Consulting Botanist's Reports are furnished to enable Members,—purchasers of seeds and corn for agricultural purposes,—to test the value of what they buy, and are not to be used or made available for advertising or trade purposes by seedsmen or otherwise.

INSTRUCTIONS FOR SELECTING AND SENDING SAMPLES.

In sending seed or corn for examination the utmost care must be taken to secure a fair and honest sample. In the case of grass-seeds the sample should be drawn from the centre of the sack or bag, and in all cases from the bulk delivered to the purchaser. If anything supposed to be injurious or useless exists in the corn or seed, selected samples should also be sent.

When possible, at least one ounce of grass and other small seeds should be sent, and two ounces of cereals or larger seeds. The exact name under which the seed has been bought (but preferably a copy of the invoice) should accompany the sample.

Grass seeds should be sent at least four weeks, and clover seeds two weeks before they are to be used.

In collecting specimens of plants, the whole plant should be taken up, and the earth shaken from the roots. If possible, the plants must be in flower or fruit. They should be packed in a light box, or in a firm paper parcel.

Specimens of diseased plants or of parasites should be forwarded as fresh as possible. Place them in a bottle, or pack them in tinfoil or oil-silk.

All specimens should be accompanied with a letter specifying the nature of the information required, and stating any local circumstances (soil, situation, &c.) which, in the opinion of the sender, would be likely to throw light on the inquiry

Parcels or letters containing seeds or plants for examination (carriage or postage prepaid) must be addressed to Mr. W. Carruthers, F.R.S., Central House, Central Hill, Norwood, S.E.

It is necessary that before the purchaser of seeds send the sample for examination he secure—

1. That the vendor specify the nature of the article supplied.

2. That the bulk be true to the bulk specified.

3. That it contain not more than 5 per cent. of seeds other than the species ordered.

4. That the germinating power shall be, for cereals, green crops, clovers, and timothy grass, not less than 90 per cent.; for fox-tail, not less than 50 per cent.; and for other grasses not less than 70 per cent.

The Council strongly recommend that the purchase of prepared mixtures should be avoided, and that the different seeds to be sown should be purchased separately.

II. ENTOMOLOGICAL.

Determination of the species of any insect, worm, or other animal which, in any stage of its life, injuriously affects farm crops, with a report on its habits and suggestions as to its extermination .. .. *2s. 6d.*

Parcels or letters containing insects, or plants apparently infested with insects, sent for examination, must be addressed to Miss ORMEROD, F.R.Met.Soc., Dunster Lodge, Spring Grove, Isleworth.

Election, etc., of Members.

Nomination.—Every candidate for admission into the Society must be proposed by a Member; the proposer must specify in writing the name, rank, usual place of residence, and post-town of the candidate, either at a Council or by letter to the Secretary. The Secretary will inform Members of their election by a letter, in such form as the Council may from time to time direct.

Subscriptions.—1. Annual.—The subscription of a Governor is £5, and that of a Member £1, due in advance on the 1st of January of each year, and becoming in arrear if unpaid by the 1st of June. 2. For Life.—Governors may compound for their subscription for future years by paying at once the sum of £50, and Members by paying £10. Governors and Members who have paid their annual subscription for twenty years, or upwards, and whose subscriptions are not in arrear, may compound for future annual subscriptions, that of the current year inclusive, by a single payment of £25 for a Governor, and £5 for a Member. No Governor or Member can be allowed to enter into composition for life until all subscriptions due by him at the time shall have been paid. Governors or Members not resident in the United Kingdom, will be required on election to pay the life composition.

Payment.—Subscriptions may be paid to the Secretary, in the most direct and satisfactory manner, either at the office of the Society, No. 12, Hanover Square, London, W., between the hours of ten and four, or by means of post-office orders, to be obtained at any of the principal post-offices throughout the kingdom, and made payable to him at the Vere Street Office, London, W.; but any cheque on a bankers' or any other house of business in London, will be equally available, if made payable on demand. In obtaining post-office orders care should be taken to give the post-master the correct Christian name and surname (H. M. Jenkins) of the Secretary of the Society. No coin can be remitted by post unless the letter be registered.

Privileges.—Free admission to the Show-Yard and to the Grand Stand at the Country-Meetings, during the time the Show is open to the public, by tickets issued by the Secretary; Exhibition of Live

Stock and Implements at the Country Meetings at a reduced charge; the *Journals* of the Society which belong to the year for which their subscription bas been pain, transmitted by post, free of charge, to their address; analyses of Manures, Feeding Stuffs, &c., made at a reduced charge by the Consulting Chemist (pp. cxx, cxxi), and examination of Plants and Seeds by the Consulting Botanist, and of Insects, &c., by the Consulting Entomologist (pp. cxxv, cxxvi); the liberty of consulting the books in the Library; leave to report the outbreak of disease among cattle, sheep, and pigs, and to request the personal attendance of one of the Society's Veterinary Inspectors; power of sending cattle, sheep, and pigs to the Royal Veterinary College on payment of a small sum for keep and treatment (p. cxxiii). No member in arrear of his subscription is entitled to any of the privileges of the Society.

Liabilities.—All Members belonging to the Society are bound to pay their annual subscriptions, until they shall withdraw from it by notice in writing to the Secretary.

Journal.—The Parts of the Society's *Journal* are published half-yearly, and (when the subscription is not in arrear) they are forwarded by post to Members residing in the country, or delivered at the Society's office to Members, or to the bearer of their written order.

The back numbers of the *Journal* are kept constantly on sale by the publisher, JOHN MURRAY, 50A, Albemarle Street, W.

*** All Communications intended for the Society should be addressed to the Secretary, at the House of the Society, 12, Hanover Square, London, W. Replies by Post Office Telegraph cannot be sent unless paid for in advance, and cannot be guaranteed in any case.